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THE
SOLDIER'S MANUAL
OF
RÍFLE FIRING,
AT VARIOUS DISTANCES.

THACKERAY'S STADIUM.



[See page 64.]

THE
SOLDIER'S MANUAL
OF
RIFLE FIRING,
AT VARIOUS DISTANCES.

BY
CAPTAIN THACKERAY,

(Retired List.)

SECOND SOMERSET MILITIA,

AUTHOR OF "THREE LECTURES ON THE PRACTICE OF RIFLE FIRING," "THE MILITARY
ORGANIZATION AND ADMINISTRATION OF FRANCE," ETC. ETC.

THIRD EDITION,
CAREFULLY REVISED, AND CONSIDERABLY ENLARGED.

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LONGMAN, BROWN, GREEN, LONGMANS, & ROBERTS.

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TO THE BRITISH ARMY

This Essay

IS DEDICATED BY

THE AUTHOR.

The soldier should have this truth impressed firmly on his mind, *that it is better to fire one shot with effect in ten minutes, than to fire ten ineffectual shots in one minute.* It does more execution, and does not waste ammunition.

PREFACE

TO THIRD EDITION.



SINCE the publication of the former edition of this work, two great changes have taken place in military matters—the introduction of rifled cannon, and the creation of a Volunteer Force in England.

Rifled cannon have given to the artillery its old superiority, restoring the relative importance of guns and small arms; their individual positive efficiency, however, being materially increased. Rifled cannon are now the powerful arms against masses at a distance; but rifled small arms will still play a large part in future warfare. In all probability, the old military tactics may be essentially changed, and, to give full effect to the powers of the rifle, much more use will be made of infantry, as skirmishers. It will be as skirmishers that the new Volunteer Force will, probably, render the most useful aid in the event of their services being called into requisition; and, in this view, we would impress upon them the necessity of using every means to become efficient marksmen, and skilful in the use of the rifle. We are only repeating the opinion of many military

men most competent to form a judgment, when we say that the precepts of this treatise being sedulously followed, no man of ordinary qualification can fail to become a thorough rifleman.

Being so, if, when called into action, he takes up a good position, he, with his single arm, may seriously harass and injure an enemy; in corroboration of which statement we would quote the observation of a distinguished military officer, who says:—

“Arms of precision are most dangerous at great distances, and volunteers, especially, should be taught to take this advantage of them. A single rifleman in a stable is more difficult to dispose of than a battalion in open ground; a countryman behind a tree of his garden, in the ditch that incloses it, behind the hedge with which he is, and with which his enemy is not familiar, will give a better account of his doings than a company in a plain. The business of volunteers is a sort of guerilla warfare, leaving the regular army to services in the field.”

The most ordinary distances in actual warfare will probably be about 900 to 1,000 yards, and the efforts of volunteers should be to make good practice at such distance, since what to-day is amusement may become a stern reality to-morrow.

It will be seen that in this work we have laid much stress, and given very elaborate instructions as to the *estimation of distances*; and so important, in every sense,

is this part of a rifleman's acquirements, that we feel that we shall be rendering signal service to the Volunteer Forces, by especially and emphatically drawing their attention to the subject in this place.

Judging from the reports in the papers, the practice and contests for prizes by volunteers, in rifle-shooting, have been invariably at fixed targets at known distances. This is well enough, as a course of drill, and to show superiority in taking aim; but, as is well said in a leading article of a military journal,* "the whole of our theorists are thinking too much of the bull's-eye—too little of the living, active, experienced enemy." Before an enemy, we are called on to fire always at previously unknown distances, and, more frequently than otherwise, at distances varying with every shot. Now, the firing at targets, at known distances, might assist us in acquiring a facility to estimate such distances, if their estimation were in such case necessary, but it is not. Our attention is wholly given to the striking the bull's-eye, and all we have to do to this end is the "mechanically" regulating the sights, and handling our rifle skilfully. This should not be; the distance of the targets in rifle contests should not be previously known to the competitors, and that, as well as the precision of aim, and the measures necessary to the firing at the unascertained distance, should be left solely to their skill and judgment.

* *Army and Navy Gazette*, Feb. 2nd, 1861.

Great care has been taken in the revision of this work, and large and important additions have been made in it, arising out of the experience gained by the present extended use of the rifle.

T. J. T.

JUNIOR UNITED SERVICE CLUB,
1861.

PREFACE

TO SECOND EDITION.

HAVING, on the calling out of the Militia in 1853, given some lectures on the principles and practice of musketry, I was requested, with a view to their being rendered more generally useful, to publish them.

They were given to the public in an extended form as "THE SOLDIER'S MANUAL OF RIFLE FIRING."

This work being out of print, and many applications having been since made for it, I have been induced to prepare a Second Edition; which has been carefully revised and considerably enlarged.

The added portions relate more especially to theoretical points; a thorough knowledge of which has appeared to be of much importance: but, in this respect, they are limited to such as seemed to be strictly necessary, the Enfield Rifle being provided with mechanical means of adaptation to various distances of point-blank range of the graduated sight.

In this work the Enfield Rifle being placed in the hands of the soldier, he is taught its mechanism and

use. This has been endeavoured to be done in the most plain and practical manner ; in such popular language, moreover, as will, it is hoped, be easily, and generally, intelligible.

A series of Lessons on the subjects treated in the work, in the shape of questions, is subjoined ; which, if studied with the corresponding answers by the soldier, will, probably, very much lighten the labours of the Instructor.

It will be obvious that this is not intended as a scientific work, but one of practical utility ; containing such information as will materially assist the soldier in becoming efficient in the use of the rifle ; being at the same time an effectual aid to the Instructor.

T. J. T.

JUNIOR UNITED SERVICE CLUB,

JUNE, 1858.

INTRODUCTION

TO FIRST EDITION.

BEFORE entering more particularly upon the subject of this treatise, it may not be without interest to give some brief history of the various inventions of portable arms, for the projection of offensive missiles, which have at length produced the Rifle, in its present comparatively perfect state.

Arms of projection occupied but a secondary place in ancient warfare. The sling, and some others for the projection of stones, the bow and cross-bow for the projection of arrows, were among the rude weapons of times preceding the 14th century.

The arquebus, a later invention, supplied a transition, as it were, between these and the more modern arms in which projectile force is derived from gunpowder. This implement was formed of a tube, from which leaden balls were thrown by means of a cord suddenly released from a powerful spring.

The invention of powder occasioned a complete revolution, not only in the art of war, but in warlike weapons.

The first portable fire-arms were made in the 14th century; the ancient arquebus supplied the primitive

idea of these arms. The tube or barrel from which the ball or projectile issues is still preserved, the projectile force of the cord being superseded by that of gun-powder.

The first kind of fire-arms was a species of small cannon, borne by two men. They were fired from a rest, by a lighted match; to these succeeded the Culverine, so called from its being principally constructed of brass or bronze, a more manageable implement, although still very rude and imperfect.

This, about 1480, was followed by the Petronel, or Poitrinal, which derived its name from being supported on the chest or poitrine (the French term for the chest) of the person using it; this was also often called an arquebus.

The frequent wars of the 14th and 15th centuries caused a very rapid extension in the use of the fire-arms of those times. In 1364, about 500 fire-arms were manufactured at Perugia. In 1404, at a review of the army at Padua, a considerable number of men were armed with hand cannon and arquebuses.

In 1414, the Burgundians, who defended the city of Arras against Charles V., had fire-arms from which leaden balls were projected.

The Swedes made use of fire-arms in the 14th century, and in 1431, the city of Stockholm had its Arquebusiers.

In 1449, Piccignini and Gonzagues left Milan with 20,000 men armed with arquebuses, to raise the siege of Marignan.

At the battle of Morat, in 1476, the Swiss, in their army of 31,000 men, reckoned 10,000 men armed with fire-arms.

The first fire-arms were discharged by a lighted match *applied by the hand*, but towards the close of the 14th

century this was replaced for portable fire-arms, by a mechanical contrivance, although very rude and inconvenient, called a serpentine, by which the match was brought in contact with the powder : to avoid accident, however, this match was extinguished during the operation of loading, and lighted after that operation was complete ; so that little was gained by the invention.

A considerable advance was, however, made in 1517, by the invention, at Nuremburg, of the wheel or German lock. This was a small wheel of steel, caused to revolve quickly in connection with a piece of metal, being an alloy of antimony and iron ; and which, through the friction occasioned by this rapid movement, disengaged sparks of fire, by which the powder was ignited.

This was afterwards replaced by a rude flint lock, at a later part of the same century.

About 1521, the Musket, (being a modification of the petronel or arquebus, in which the butt or stock was supported on the right side of the chest or shoulder, whilst the other end rested on a portable support or rest,) was introduced, and was employed for the first time in that year in the army of Charles V. From this time to the commencement of the 17th century considerable extension was given to the use of this weapon, and at that period the infantry were almost universally composed of musqueteers and pikemen ; the former, as their names import, armed with muskets, the latter with pikes.

The first muskets were very heavy, and threw balls of eight or ten to the pound weight to considerable distances ; but their inconvenience being greater than their utility, they were gradually reduced in length, and calibre, or bore, until they were rendered

tolerably easily portable, and could be fired from the shoulder.

From the Musket the gradation to the Rifle, from the rude flint to the percussion lock, has been made from time to time, until resulting in the almost perfect weapon we now possess.

We cannot pass over, in complete silence, some of the later inventions, which have contributed so much to the efficiency of the Infantry, by furnishing them with weapons that leave the old musket at an immeasurable distance.

Since 1840 various and important has been the progress of invention. In that year a new form of Rifle, possessing considerable advantages, was adopted in France. This was followed, in 1842, by a Rifle, much improved, by Captain Delvigne, of the French army; and this again was succeeded by the well-known "Minié Rifle à tige,"—so named from the particular form of a ball invented by Captain Minié, who also belongs to the French army. Our transatlantic brethren, the Americans, have not been behindhand in the race of invention; and some of them have, as is well known here, been lately exhibiting a "breech-loading and self-cleaning Rifle," which is very favourably reported of. The Prussian needle-gun is another form of Rifle, which is stated to possess peculiar merit; and a modification of this, by one of our own makers, Mr. Needham, of Piccadilly, lays claim to great consideration. In this Rifle capping and cocking are entirely dispensed with; and it can, it is asserted, be loaded and fired twelve times in a minute, and will shoot with great precision.

There is another important invention by Lancaster, of London, which may be termed an anomaly in gun making, and which he calls his Patent smooth-bored Rifle. *It is elliptical, and not cylindrical in its bore; and from*

experiments made at Woolwich, before competent authorities, the following results were obtained :—

At 500 yards, 2 out of 4 shots hit the bull's eye.

At 400 yards, 2 out of 3 shots hit the bull's eye.

At 200 yards, 6 shots fired all round the bull's eye.

From experiments made the same day upon the Minié or French Rifle, the following results were obtained :—

At 500 yards, 1 out of 4 shots hit the bull's eye.

At 400 yards, 1 out of 3 shots hit the bull's eye.

At 200 yards, the whole six struck the target ;

giving on these experiments a vast superiority in favour of Lancaster's invention over the Minié or French Rifle.

The improvements recently introduced in rifles have obtained for these weapons a degree of range and precision, of which, but a few years since, no one would have considered them susceptible.

These qualities, and the general introduction of the rifle into the army, must, of necessity, give an importance to infantry superior to any they have hitherto attained ; and will modify considerably any operations in which they may be hereafter engaged. Instead of being placed, as formerly, at a distance comparatively near to an enemy, great advantages will result in their being employed at a distance of 500 or 600 yards, or even more. Instead of always acting in large bodies, some of their most efficient services will be rendered in small detachments. The fire of infantry being much more effective, and at greater distances, their value in the field, in comparison with cavalry and artillery, will be very materially augmented.

Cavalry will be exposed to their destructive fire, without the possibility, from their distance, of checking it ; and a few expert shots, well stationed, and availing themselves of the cover afforded by the accidental formation of the ground, will be able to silence artillery by

picking off the men,* and to render it inefficient by disabling the horses, without affording any chance of being harmed by the guns; and even should they be unable to obtain cover, the mark that would be afforded by detached and single men would be so small, and the distance so considerable, that artillery would have but a very unequal chance. Added to this, the infantry soldier could fire eight or ten times to a large gun's once: and thus might one man clear every gun of its men for one shot fired against him. Cavalry and artillery would thus lose much of their comparative value in the field.

This view of the matter, however, is dependent on the supposition that infantry render themselves as efficient in the use of the rifle, as the rifle, owing to its present improvement, is efficient.

* Since the first edition of this work was published, we have had in the Crimean and Indian wars many examples of the correctness of this observation; one of which we cannot forbear to quote from the columns of the *Times*:—

“The victory achieved by General Franks furnishes a striking example of Indian strategy. The artillerymen had fixed their pieces solidly, on the assumption that our necessary advance from a particular quarter would call for a fire in one direction only. As General Franks, however, chose to act not according to this theory, but to his own judgment, half their guns were useless, and the rest were soon silenced by an operation which deserves special attention. The General threw forward a picked body of Enfield marksmen; and *these sharp-shooters ‘cleared the batteries in three minutes.’* As General Franks had no regular rifle corps in his column, this service must have been performed by the rank and file of an ordinary battalion, armed with the new musket, and the example should not be lost on our military, or regimental, authorities.”

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MANUAL OF RIFLE FIRING.

THE object of this Treatise is to afford the soldier such information on rifle firing as shall, if carried out in practice, make him efficient in that branch of his duty. With a view to this, a plain manner and language will be adopted, with as little use of scientific terms or descriptions as possible ; so as to bring within the intelligence of every reader, the means of clearly comprehending the subject.

We purpose treating the matter before us so as to be not only easily intelligible—but, from the simplicity of its arrangement, so to impress itself on the mind as to be made readily available for actual service.

We shall begin by giving the soldier some general directions, and shall afterwards afford him all the information that may appear to us to be essential to his perfection in rifle firing, following the order and subject of such directions.

We therefore propose that,—

Firstly. The soldier should make himself perfectly acquainted with his rifle, its different parts, and the accoutrements belonging to it. He should be able to take it to pieces, to put it together, and to keep it perfectly clean ; and to this latter point he should pay particular attention, since something of his success, as a marksman, depends on it.

Secondly. He should know what is the exact charge, and, if need be, be able to make his own cartridges, cast his own balls, &c.

Thirdly. He should know the theory of taking aim and firing, and the entire management of his rifle for these purposes; and should, by incessant practice, render himself an expert marksman and an able shot.

Fourthly. He should be able correctly to estimate distances by sight, and without the aid of instruments.

Fifthly. He should know, so as to be able to apply his knowledge at the instant, at what part of an object to aim, at any given distance.

Sixthly. He should place himself in such a position as will allow him—

To aim with ease.

To keep his body motionless.

Not to incline the sights to the right or left.

To bear the recoil of the rifle.

Seventhly. He should be able, from practice and observation, to remedy any defects in the firing of his rifle, and to make allowances for deviations of the ball, in reference to the several causes producing them.

Such are the directions that should be followed out to make a good rifleman.

The most important of these are the taking aim, and the correct estimation of distances.

In the learning to take aim and to fire, it will not, at *first*, be necessary to expend a single cartridge—all the *operations may*, and should be gone through as if the rifle

were loaded, and not until a thorough knowledge and efficiency is attained in the theory of aiming and firing, should a single grain of powder, much less a ball, be put in the rifle. After the theory is mastered, and the use of the rifle, in these operations, has become nearly perfect, then, and then only, may the learner begin by snapping some caps, and proceed afterwards to fire with blank cartridge, and, lastly, to use ball.

Before, however, he puts even a single cap on his rifle, he should learn the use of the trigger, pulling it quietly and gradually with the second joint of the first finger of the right hand, so as not to disturb the position of the rifle, or change the line of aim.

When he has mastered all that is necessary, before using a loaded rifle, he will only have, in ball-practice, to overcome the recoil—a point of minor importance, and which he will have partially accomplished by his practice with blank cartridge.

By this mode of instruction, joined with the necessary theoretic teaching, soldiers will be made superior riflemen to those who, without such preparatory practice, attempt to attain efficiency by the use of the target at an earlier stage.

The acquiring efficiency in the mere aiming and firing will be of comparatively little practical value, and more especially before an enemy, if it be not accompanied by the power and facility to judge correctly and quickly of distances. On this point it will not be necessary here to enter in detail, since the fullest instructions will be found in this work (Chap. VI.); but we would strongly impress on our readers, that it is of the very greatest importance, and of the most urgent necessity.

When the soldier has become perfect in taking aim, in firing, and in the estimation of distances, he may feel confidence in himself and his weapon, in the face of the enemy, and will not be led hastily to throw away his ammunition, which, in actual warfare, is of so much value.



CHAPTER I.

SECTION 1.

THE RIFLE

BEING the only weapon with which British Infantry are furnished, the Rifle is employed as an arm of projection, and as an arm of manual offence and defence.

1. As an arm of projection—to destroy an enemy at a distance by means of projectiles.
2. As an arm of manual offence and defence—in hand to hand combat with the Bayonet.

First. As an arm of projection, it should be easily and conveniently charged, and its fire should be certain and effective.

Secondly. As a manual arm it should be strong, of simple construction, and easily handled.

The rifle should not fatigue or embarrass the soldier in his manœuvres, his march, or its general use, and should be easily kept in order.

Attention to these matters is essential, to give the soldier implicit confidence in his arm; and we think that an examination by him of his Enfield Rifle, and, at the same time, a careful consideration of the description given of it in the "Companion to the New Rifle Musket," will satisfy him that the Government has taken all precaution, and availed itself of all the best appliances in its construction; that, moreover, it has used all means at its disposal to furnish him with an arm in which he may place great confidence.

We will now explain generally the various parts of which a Rifle is composed.

SECTION 2.

THE ENFIELD RIFLE MUSKET.

AS the British Army is now supplied with this Musket, we will, in our description of the Rifle, confine ourselves to that arm.

Its weight with the bayonet is	. 9lb. 3oz.
Length with the bayonet	. 6ft. $\frac{1}{2}$ in.
Length without bayonet	. 4ft. 6in.
Length of barrel	. 3ft. 3in.
Weight of barrel	. 4lb. 2oz.
The bore is cylindrical, and the diameter of bore is	. 557in.
The number of grooves	. 3
Depth of the grooves	. 0115in.
Width of the grooves	. 230in.

The grooves have a turn of one whole revolution in 4 feet.
It has a swivel lock.

The main-spring draws at half cock	15 to 16lb.
The sear-spring draws	. 7 to 8lb.
The pull of the lock	. 13 to 14lb.
The trigger draws	. 7 to 8lb.

The charge of—

Powder	. 2 $\frac{1}{2}$ drs. F.G.
Bullet, diameter	. 568in.
Length	. 960in.
Weight	. 520grains.

The Rifle consists of seven principal parts—

- | | |
|----------------|-----------------|
| 1. The stock, | 5. The ramrod, |
| 2. The barrel, | 6. The bayonet, |
| 3. The sights, | 7. The trigger. |
| 4. The lock, | |

1. The Stock,

Consisting of—

- | | |
|-------------------------|-----------------------|
| 1. The butt, | 5. The shaft, |
| 2. The hand (or small), | 6. The ring bands, |
| 3. The head, | 7. The catch springs. |
| 4. The swell, | |

2. The Barrel,

Consisting of

- | | |
|----------------|---------------------|
| 1. The breech, | 3. The breech nail, |
| 2. The muzzle, | 4. The lump. |

3. The Sights.

The back sight consists of

- | | |
|-------------------|--------------|
| 1. The bed, | 4. The leaf, |
| 2. The flanges, | 5. The pin. |
| 3. The slide bar, | |

The front sight is simply a small point elevated above the barrel, close to the muzzle.

4. The Lock,

Consisting of

- | | |
|---------------------|-------------------------|
| 1. The main-spring, | 6. The lock plate, |
| 2. The tumbler, | 7. The main-spring pin, |
| 3. The bridle, | 8. The sear pin, |
| 4. The sear, | 9. The sear-spring pin. |
| 5. The sear-spring, | |

5. The Ramrod,

Consisting of

- | | |
|----------------------|---------------|
| 1. The head and jag. | 2. The swell. |
|----------------------|---------------|

6. The Bayonet,

Consisting of

- | | |
|----------------|----------------------|
| 1. The blade, | 3. The locking ring. |
| 2. The socket, | |

7. The Trigger,

Consisting of

- | | |
|----------------|---------------|
| 1. The blade, | 4. The stud, |
| 2. The finger, | 5. The plate. |
| 3. The box, | |

For more detailed information as to the Enfield Rifle, we refer the reader to the "Companion to the New Rifle Musket," from which we have taken the greater part of the above description, in which work will be found plates of all parts of the rifle, so well and correctly drawn as to enable any one in a short time to become completely acquainted with the arm.

The Armourer, or Colour-Sergeants in each Regiment, will more particularly describe to the men the various parts of the rifle, and will instruct them in the taking it to pieces and putting it together, and give them particular directions as to cleaning it. It may, however, be well to give some general hints as to the cleaning, which may be useful to the soldier.

To preserve the rifle from rust, it should be rubbed over occasionally with a piece of soft rag and a little grease, prepared in the following manner :—

Take a pound of olive oil, of good quality, and half a pound of mutton suet ; melt the suet alone over a slow fire, and whilst hot, strain it through a coarse cloth. Mix the oil and suet while warm. This will make a kind of pomatum, which must be kept free from dust or dirt.

The same course should be taken with the bayonet and ramrod.

After washing and drying the barrel of the rifle, it should be rubbed inside with oiled rag, and the oil thus deposited should be left until the rifle is wanted for use, when the barrel should be cleaned out with a piece of dry rag ; and if practicable, the rifle should, before used, be flashed off with loose powder to show that it is fit for service.

After the rifle is cleaned, the cock should be carefully let down on the nipple, having a piece of oiled rag placed between the cock and the nipple, where it should remain until the rifle is wanted for use.

It sometimes happens that it is necessary to draw the charge. In this case the cap should be first removed from the nipple, and the nipple carefully cleaned from any of the detonating powder that may be left on it ; to avoid the chance of accident.

CHAPTER II.

THE CHARGE. MAKING CARTRIDGES. CASTING BALLS.

THE charge for the soldier's rifle is decided on by the proper military authorities, and may easily be ascertained by inquiry of the proper officer in each regiment,

who will also instruct the soldier in making cartridges and casting balls, as regards which it would be somewhat difficult to convey such information as would be intelligible otherwise than by practical means.

It may, however, be useful to point out, that, in casting balls, the melted lead is in a proper state, when it browns so as nearly to burn a piece of paper that is plunged into it.

In order, also, to keep the melted lead in a fit state, a layer of powdered charcoal, of about an eighth of an inch thick, should be strewed on it in the melting pot.*

CHAPTER III.

THE RIFLE AS A MANUAL ARM.

AS the instruction of the soldier in the use of the rifle with the bayonet as an arm of offence, or defence, does not form part of our present purpose, it becomes unnecessary for us to enlarge upon it.

We will, however, observe that using the bayonet somewhat in the nature of a weapon for fencing, may, under many circumstances, be of great importance, and that a course of drill in this view may furnish the soldier with a means of defence when exposed in single combat with an enemy, or when engaged in siege operations, that may often be the means of saving his life.

A system of attack, and defence, with the bayonet might be taught; and in order to avoid any chance of injury during the drill, bayonets of India-rubber, of the same make and size as the real bayonets, but so elastic as not to occasion any chance of wounding the men, might be furnished.

Men, thus provided, would not hesitate in their drill to attack and defend with energy and without fear; and, amongst them, great rivalry to become the most efficient in the use of the bayonet would naturally arise; the result of which must be that they would become as expert with the bayonet as an officer with his sword.

* We would refer the reader to the "Companion to the New Rifle Musket" for particular directions in making cartridges.

CHAPTER IV.

THE RIFLE AS AN ARM OF PROJECTION.

THE great object of this treatise being to make the soldier efficient in the use of the rifle as an arm of projection, it will become necessary to instruct him in the theory of so much of the science of projectiles as will enable him clearly to understand the principles on which rifle firing depends.

It is a principle in mechanics, that a body in a state of motion will continue in motion with the same velocity, unless there be some resisting force to lessen its velocity or stop its motion. Again, it will continue in the same line or course of motion, unless there be some resisting force to change such line or course of motion.

A bullet projected, or driven out of the barrel of a rifle, will continue its motion in the same line and with the same velocity, until it finds some resisting force to check its velocity or stop its motion, or to change its line of motion.

Now, a bullet projected from a rifle is subject to three forces :

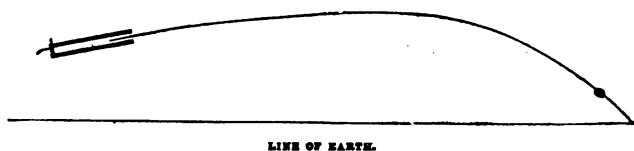
1. The *propelling* or *projecting* force of the gunpowder, which gives it motion at a given velocity in a given line.
2. The *resisting* force of the air, or atmosphere, which constantly tends to check its velocity.
3. The *resisting* force of gravity, by which the line of motion of the bullet is changed by reason of the bullet being drawn by such force downwards, or having a tendency to fall to the earth.

On the bullet first issuing from the rifle, the velocity imparted to it by the force of the gunpowder is so great that it almost wholly overcomes the two resisting or opposing forces, and therefore for a short time it proceeds in nearly a straight line ; but, as it continues its course, these two resisting or opposing forces come into more powerful operation, the velocity *being diminished* by the resistance of the air or atmosphere, *and the force of gravity attracting the bullet more strongly towards the earth.* Instead of following a straight line, the

force of gravity causes the bullet to form a bent or curved line, as in the following figure.

Fig. I.

COURSE OF BULLET.



CHAPTER V.

SECTION 1.

TAKING AIM AND FIRING.

THE general principles of taking aim and firing, applicable to the rifle, as well as to all fire-arms, are founded on the relative positions existing between three imaginary lines :

1. The line of vision.
2. The line of projection.
3. The trajectory.

The line of vision, the line of projection, and the trajectory are terms of science, but—

1. *The line of vision* may be described in plain language as “the line of sight,” or “line of aim,” or more simply still, “the aim.”

It means a supposed line from the centre of the right eye with which the aim is taken to the object which is to be struck with the ball.

2. *The line of projection.* This may be described in plain language as the course which would be taken in a straight line by the ball when “driven out” of the rifle by the gunpowder, if there were no resistance to prevent its going in one continued straight line.
3. *The trajectory, in plain language,* is the course which the bullet is forced to take by being drawn out of a straight line down towards the earth by gravity. This force of gravity drawing the ball downwards out of a

straight line, and acting continually and gradually on the ball, makes it take a curved or bent course until it touches the earth. The principle of this has been already explained in page 31 and fig. I.

In scientific language these three lines (fig. II.) are defined as follows :—

The line of vision is a right or straight line passing from the centre of the eye through the centre of the back sight on the rifle, to the point of the object to be struck.

The line of projection is a right or straight line drawn through the axis, or centre, lengthwise, of the barrel of the rifle, and extending beyond the barrel to any supposed length.

The trajectory is a curved, or bent line, followed or taken by the centre of the ball, in its progress through the air from the rifle to the object.

Now, in order to the certain understanding of these lines, after having studied them in fig. II., lay a rifle sidewise down on a table, and with a piece of chalk draw a straight line through the sights to any indeterminate distance—this will be the line of vision.

Draw another straight line from the centre lengthwise of the barrel—this will be the line of projection.

Draw a curved or bent line, beginning in the same direction with the line of projection, and afterwards crossing the line of vision at two points, as shown in fig. II.—this will be the trajectory.

It is absolutely necessary, before going further, to study these lines, in order thoroughly to understand them, for a correct knowledge of them lies at the very foundation of good rifle firing.

The principles affecting the passage of the ball from the rifle have been already explained in page 30, and it will be remembered that the bullet is shown to form in its course a bent or curved line—this line is the trajectory.

There is a very simple manner of showing the principles of the trajectory, which is familiar to every one—the common act of throwing a stone. We know that if we throw a stone, it has a tendency, from the moment it leaves the hand, to fall to the earth; and, therefore, if we wish to strike an object beyond a certain distance, we throw the stone higher into the air, in order that it may not reach the earth at a point *nearer to us than the object*. The stone, in the same manner

from the rifle, forms a line from the moment that the bullet by the hand, ceases to overcome the effect of gravity of gravitation. This in effect the trajectory. The bullet is considered as the rifle and as the rifle.

Now apply the principles of the preceding page to the

seen in tracing the course of the bullet from the barrel of the rifle, the line of projection, and the trajectory in the same course from the barrel for some short distance they separate; the line of projection continuing in one uninter-rupted course, and the trajectory following the line of projection, and the trajectory. The projecting force of the bullet is driven out of the barrel sufficient to overcome the resistance of the air, and the bullet follows the line of projection; but gravity, as the projecting force is lost by the resistance of the air, the bullet is subject to the force of gravity, and forms a curved line, until it falls to the earth.

of the resistance of the air from a rifle is so con- siderable in some cases it will be ten or twenty times the weight of the ball, so that a bullet, from the resistance of the air will not travel to a distance of 10,000 yards the resistance of the air will be 1000 yards or less.

force of the air, therefore, is a material element in the curve of the trajectory, and consequently in the range of the rifle.

curve of the trajectory, if the bullet were fired?

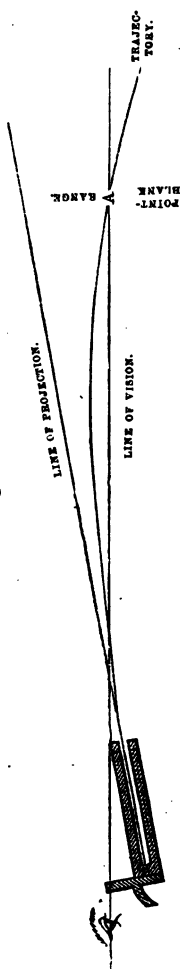


Fig. II.

in a space deprived of air (called by scientific men a "vacuum"), would be somewhat like that shown in the following figure, and included between the letters A B,

Fig. III.



whilst the curve, when the ball is fired (as is always practically the case) in the open air, would be somewhat similar to the curve, A C. Thus it will be seen that a ball, when subject to the resistance of the air, by which it loses its velocity, comes much sooner to the earth than it would do if there were no such resistance, because in that case there would be nothing to lessen its velocity, and it would continue its course until the whole force which projected it was expended, and then it would by the force of gravity fall to the earth. For our present purpose, we do not consider it necessary to take into account the effect of gravitation on the *velocity* of the bullet.

That which determines principally the striking the mark aimed at by the projectile (a bullet) is the regularity of its movement in the air; but this regularity of movement is subject to so many causes of modification, and some of them involving such abstruse mathematical calculations, as to render it not desirable, even were it useful, to enter into them fully in this work. We shall, therefore, treat the matter in a general and practical manner, which will be all that will be requisite for the purposes of this manual.

We will begin by supposing that the projectile (the bullet) is propelled (or fired) in a space in which there is no air, called a "vacuum," and will then consider what general changes will take place in the direction of the bullet from the resistance of the air.

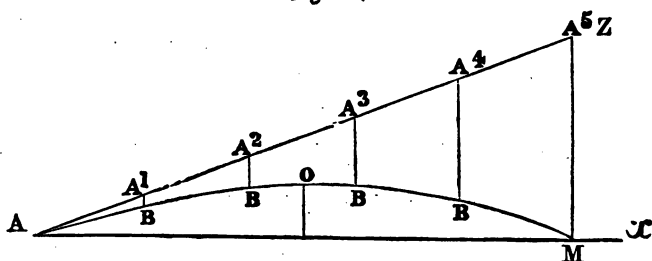
We will now consider the case of a bullet fired in a "vacuum."

A bullet fired in a "vacuum" is only subject to the action of *two forces*—viz., the projecting force, which tends to *propel it with a uniform velocity* in the direction of the axis

of the barrel of the rifle, and the force of gravity, which causes it to deviate from such direction and to draw it to the centre of the earth, or downwards, with a continually increasing rate of motion, so that the bullet not being able to obey wholly either of these forces, follows the line of the trajectory, which is placed between the line of projection and the earth.

We will endeavour to make this understood by the following figure.

Fig. IV.



From the point A draw a line of indefinite length—A x —and from the point A draw also the line A Z; the line A Z will indicate the line of projection.

If the bullet were subject to no other force than the force of projection, it would arrive at given and equal times successively at the points A 1, A 2, A 3, A 4, &c., on the line A Z. But during the passage of the bullet from A to A 1 (that is, we will suppose, during one second of time), the bullet has been subject to the force of gravity, and has been compelled to obey such force; the consequence of which will be that the bullet, having been drawn downwards towards the earth, will have arrived at B. During the passage from B to A 2, being another second of time, it will have arrived at B 1, or the second B, counting from left to right, and so on successively.

Now, if we draw the curve A B, B, &c., M, we shall have the trajectory formed by a bullet fired in a "vacuum."

The figure, it will readily be seen, is but arbitrary, and neither the lines, nor the times assumed, are correct, but will be sufficient to show the principle, which is all that is necessary to our present purpose.

It will be observed, on reference to the figure, that the

trajectory rises gradually from the point A of the line of projection, above the horizontal line A α , up to a certain point O, from whence it gradually descends until it touches the earth at M, on the horizontal line A α . The point O is called the "*culminating point*," and will be found, by drawing a line parallel to A α , touching the highest point of the trajectory.

The reason, it will be remembered, that the trajectory rises from A to O, is that the projecting force of the gunpowder is sufficient up to the point O to overcome, to a great extent, the force of gravity.

It will be seen that in proceeding from the point A to the point O, the bullet has passed over the same distance in the same time as it has done in descending from the point O to the point M.

This will sufficiently explain the effect of a bullet fired in a "vacuum."

We will now proceed to consider the different effect that will be produced on a bullet fired in the open air.

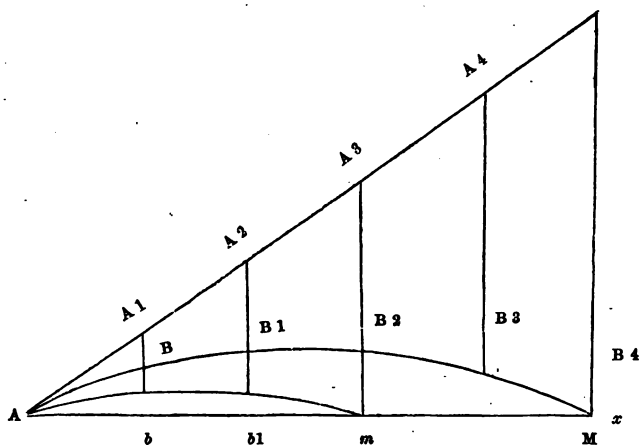
The air, or atmosphere, as is well known, surrounds the earth; and is without colour, is invisible, and is not sensible to the touch, but, nevertheless, it still is capable of offering a resistance to any body or thing which is pressed against or passing through it; as we must all be sensible when we run quickly, or pass through it rapidly, on horseback, or when we draw downwards an open umbrella. It consists of very small particles or globules, and these particles are compressed by any body passing through them, or, in other words, are forced into a closer mass, and will therefore require corresponding force in such body to remove them, and overcome their resistance, and the greater the velocity of the body the greater is in equal ratio the resistance of the air.

This resistance is offered principally in a line directly opposite to the line of motion of the body; but besides this, there is a resistance offered by the friction of these particles through which the body is passing. The sum, or force, of these resistances affords a material check to the velocity of the body, and in time destroys such velocity. The resistance offered to a rifle bullet depends on—

1. The density of the air.
2. The extent of surface of the bullet.
3. The velocity of the bullet.

We do not intend to enter upon any mathematical calculations to demonstrate the laws of resistance, which would be too complicated and foreign to our purpose, but must content ourselves by showing by an arbitrary figure, which will be sufficient for that we have in view, the difference in the form of the trajectory occasioned by the resistance of the air. We will repeat the figure, page 35, in which we showed the form of trajectory of a bullet fired in a "vacuum," and add to it in juxtaposition, and as a means of comparison, a trajectory of a bullet fired in the open air.

Fig. V.



The trajectory of the bullet fired in the air is shown in the figure by the line $A b b_1 m$.

Now it will be seen that instead of the bullet forming the trajectory $A M$, as it did when fired in a "vacuum," it will, from the resistance of the air, trace a trajectory of a very different form, having the portion b_1 to m considerably shorter than the portion B_1 to M , and having the curve $b_1 m$ instead of the curve $B_1 M$; or, in other words, the bullet having lost much of its velocity in passing from A to b_1 , will descend from b_1 to m in less time than it occupied in passing from B_1 to M , and will form a shorter curve.

Thus, on a revision of this section, it will be seen that the resistance of the air completely modifies the conditions of the trajectory of a bullet fired in a "vacuum," and an idea may thus be had of the effect of the resistance of the air on the bullet.

SECTION 2.

TAKING AIM AND FIRING.

WE shall now explain some points necessary to be understood.

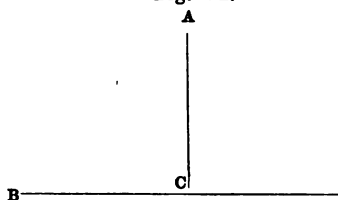
The Point-Blank.—The second point of intersection of the line of vision by the trajectory (A, fig. II.) is called the point-blank.

*Point-blank range.**—The distance measured on the line of vision from the muzzle of the barrel to the point-blank.†

Vertical.—Vertical means in common language, upright.

Horizontal.—Horizontal means in the same language, lying flat, or level; thus—

Fig. VI.



A is a vertical line, and B a horizontal line. This will, we think, be rendered easily intelligible by the common level used by every carpenter and mason.

* There are two definitions of the term "point-blank range."

1st. The ordinary, or popular definition, which is the distance from the muzzle of the barrel of a rifle to that point at which a ball first strikes the earth, when fired from a gun laid in a horizontal line at a certain height from the ground.

2nd. The distance from the muzzle of the barrel of a rifle to that point of the line of vision at which the trajectory cuts, or passes through the line of vision the second time.

We have adopted in this work the second definition, and have used the term "point-blank range" in the same sense throughout, in order to avoid error and confusion, and because it is more correct.

† There is a different point-blank range to each line of vision corresponding with the distance of the point-blank.

This level is composed of two straight edges joined together, and forming two sides of a square, as A C B in the above figure ; from A to C is hung a line, having a piece of lead at the bottom, called the plumb-line. Now if the straight edge, B C, be placed on the ground, and A C be placed perfectly upright, so that the plumb-line hangs exactly even, the straight edge, A C, will be vertical, or, in common language, upright, and the straight edge, B C, will be horizontal, or in common language, level—the term vertical meaning that the straight edge, A C, is exactly in an upright or straight line that points directly to the centre of the earth, because the plumb-line hanging exactly even, the plumb is by the force of gravity attracted directly to the centre of the earth ; and the term horizontal meaning that the straight edge, B C, is exactly in a flat or level line with the horizon, because, forming one side of a square with A C, if A C be perfectly upright or vertical with relation to the centre of the earth, B C must necessarily be perfectly flat or level with the horizon, the horizon being at right angles with the vertical.

Plane.—A plane being a simple idea, is difficult to describe in common language, but will probably be understood if we say that it is an even surface, like, for example, a piece of card-board.

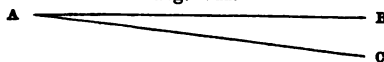
Vertical plane.—Now if a piece of card-board be placed exactly upright, it will be a vertical plane.

Horizontal plane.—If it be placed exactly level, it is a horizontal plane.

If after having so placed the card-board it be removed, the space which was occupied by the card-board will in fact be what in scientific language is called a plane, and a vertical or horizontal plane, as the case may be.

Angle.—The space that is between two straight lines which meet each other at the point where they join, is called an angle ; thus—

Fig. VII.



The two straight lines—B and C—meeting each other at A form an angle at A.

Angle of projection.—The angle of projection is the angle that the line of projection forms with the horizon at the moment of firing.

Angle of vision.—The angle of vision is the angle formed by the line of vision with the line of projection.

Plane of projection.—A plane which is vertical, and contains the line of projection at the moment of firing, is called the plane of projection.

The trajectory is wholly in this plane. It is at first coincident, or similar to the line of projection, but afterwards deviates from it, more and more, rising and falling as the ball's distance from the muzzle of the rifle is increased.

When the line of vision is horizontal, and placed in the plane of projection, the angle of vision is equal to the angle of projection.

The trajectory and the line of vision may be considered as invariably related when the latter of these lines is in the plane of projection.

In this case, if the line of vision be raised or depressed, or be directed to the right or left, the trajectory participates in these different movements, and always preserves in all its parts the same position relatively to the line of vision; provided that too great an inclination above or below the horizon be not given to it.

Since the trajectory is contained in the plane of projection, if care be taken to place the line of vision in this plane, and to direct this line of vision on the vertical passing through the point to be attained, the ball will touch in some part the vertical in question, if such line be not without the limits of the range of the rifle. In order that the part of the vertical shall be precisely the object to be struck, it only remains to direct the line of vision (or what is the same, the eye looking along the bottom of the notch of the back sight and the top of the front sight) on that point of the vertical where is the object to be struck.

The point in question will be determined by how much the trajectory rises above, or descends below, the line of vision; at the distance between the object and the muzzle of the rifle.

If, for example, it be known that the trajectory, at a certain distance, descends a yard below the line of vision, it will be necessary, in order to strike an object situate at such a distance, to direct the line of vision (or, in other words, to take aim) a yard above such object. For if the line of vision were directed, or aim were taken, exactly to such object, the ball, or trajectory, would pass a yard below it, as shown in

fig. VIII. But if the line of vision be directed, or aim be taken, a yard above the object, the trajectory will follow relatively the movement of the line of vision ; will preserve, with reference to this, its first position ; and will, consequently, pass a yard below the point sighted ; that is, will exactly meet the object.

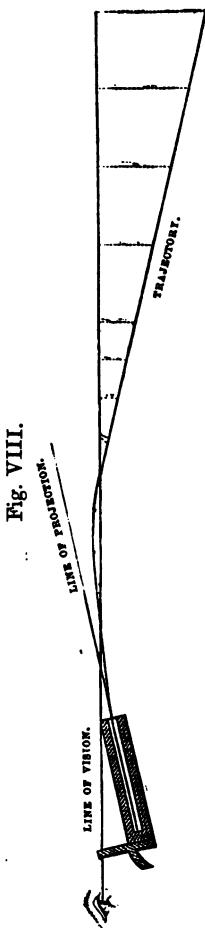
It must be kept in mind that the line of vision is placed in the plane of projection, when, at the moment of firing, the notch of the back-sight and the top of the sight near the muzzle of the barrel are not inclined either to the right or left of a vertical plane leading to the eye, and passing through the middle of the barrel lengthwise ; and care must, therefore, be taken to hold the rifle so that the sight is directly vertical, or, in popular language, upright.

The firing of the rifle then can be regulated by means of the line of vision, when the position of different points of the trajectory relatively to this line is known, and when care is taken to place the two sights of the rifle vertically in the plane of projection.

If the trajectory and the line of vision, in the position which they should occupy with relation to each other, be examined, it will be observed that the trajectory cuts, or intersects, the line of vision at two points, one very near the muzzle of the rifle, and the other at a greater distance.

The second point of intersection of the trajectory and the line of vision, is called the point-blank ; and a line measured on the line of vision from the muzzle of the barrel to the point-blank is called the point-blank range, as has before been stated.

To each line of vision a special point-blank and point-blank range correspond. The point-blank range is lengthened in proportion as the notch or opening of the back-sight of



the rifle is raised, by which a greater elevation is given to the barrel of the rifle, the muzzle of the rifle being raised in proportion to the raising of the back-sight.

It will be observed (fig. VIII.),

"That beyond the point-blank range the trajectory descends below the line of vision, and the more so as the ball's distance from the rifle is increased.

"That within the point-blank range, between the two points of intersection by the trajectory of the line of vision, the ball rises above the line of vision in different degrees, according to the position under consideration.

"That the elevation of the ball is very small near the points of intersection, and greater towards the middle of the line of vision, which joins these two points.

"That, from the muzzle of the rifle to the first intersection, the centre of the ball is below the line of vision, in different degrees, according to the point from which the centre of the ball is considered, or taken; but these degrees are all very small, so that in this part of its course the ball may be practically regarded as being on the line of vision."

Since at a distance equal to the point-blank range the trajectory meets the line of vision, it will be sufficient to direct the line of vision to such point to strike an object situated at that distance.

Since beyond the point-blank range the trajectory descends below the line of vision, it will be necessary, in order to strike an object situate at a greater distance than the point-blank range, to direct the line of aim above the object, for if it were directed straight to the object, the trajectory would pass below it.

To determine the elevation of the sight to be taken so as to strike the object, it is only necessary to know the descent of the trajectory below the line of vision at the distance at which the object to be struck is placed. The elevation that should be taken above the object is equal to this descent. This will be evident when it is remembered that the trajectory is relatively connected with the line of vision.

It will be equally clear that to strike an object situate between the two intersections by the trajectory of the line of vision, a sight must be taken below the object at a point vertically as much below the line of vision as the trajectory

is above the line of vision, at the distance at which the object to be struck is placed.

It must be observed that to strike an object at the same distance from the muzzle of the rifle, as the first intersection of the line of vision and the trajectory, the object must be aimed at directly.

Such are the general conditions for firing. They may be reduced to the following general rules :—

When the object is situate at one of the points of intersection of the trajectory and the line of vision, the object *itself* must be aimed at, care being taken, if the object is at point-blank range, to fix the back sight of the rifle in accordance with such range.

When the object is situate between the two points of intersection, an aim must be taken as much below the object as the trajectory rises above the object.

When the object is situate beyond the point-blank range, or the second point of intersection of the line of vision and the trajectory, an aim must be taken above the object, and the further the object is removed, the higher must be relatively the aim.

When the object is situate between the muzzle of the rifle and the first point of intersection, an aim must be taken as much above the object as the trajectory passes below the object.

These general principles being well understood, the next point will be to reduce them to practice.

SECTION 3.

TAKING AIM AND FIRING.

SINCE sights on the rifle are provided so as to indicate the range, or in other words the point-blank where the trajectory the second time cuts or crosses the line of vision, the foregoing observations are intended chiefly for the information of the soldier on the theory of rifle-firing rather than for any practical necessity ; and the same reason will render

useless our entering here into any mathematical calculations to determine the point-blank range for given distances. No other operation will be required on the part of the soldier, than merely regulating the sight corresponding with the distance, as shown by the graduated scale of the sight.

The back-sight has a graduated scale, which is numbered from 100 yards to 900 yards—the distances 100, 200, 300, 400, 500 yards are given by the lines on the side of the body of the sight; the distances from 500 yards to 900 yards are shown by shifting up gradually the slide on the tangent leaf.

The explanation of this graduated scale, and the means of adapting it, will lie with the instructor; by whom a very short tuition will render the soldier thoroughly competent on this point.

The first part of the instruction of rifle firing may commence in the barrack-room or yard, and should consist in the instructor describing to each man individually the sights on the rifle, their use as affecting the range, the mode of shifting them, and how to point and level the rifle at all distances, and explaining to the men the general principles of taking aim and firing.

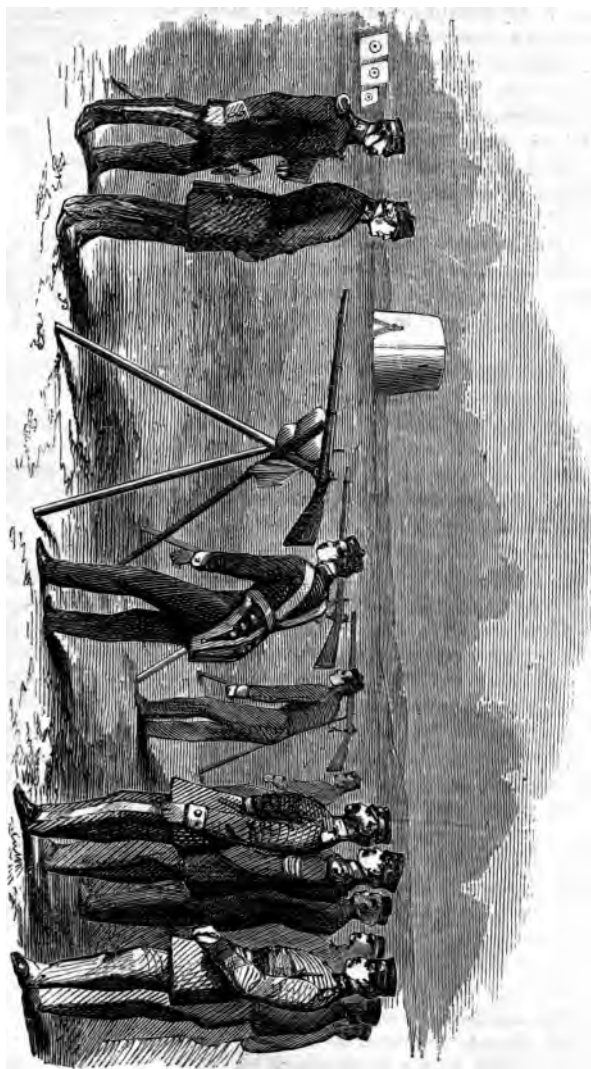
The soldier's first practice will be to take aim accurately; for which purpose a *traversing rest* should be provided: this traversing rest is a piece of wood scooped out to receive the rifle, placed on a stand, and capable of being elevated, depressed, or made to traverse or turn at will. In the absence of this, an ordinary sand bag* may be placed on a triangle formed of three legs, or on the barrack table or window sill. On this rest, or sand bag, the soldier should place his rifle, and take an aim; using the sight appropriated to some given distance: the best object for this practice will be a straight rod placed quite upright, or a wafer stuck on the wall or window. When taking aim, the left eye should be closed.

Having taken aim, the soldier should leave his rifle on the rest, which should be examined by the instructor, to ascertain that the sight is properly adapted, that the front and back sights and the object exactly cover each other, and that the aim is perfectly true.

When the aim is ascertained by the instructor to be

* A space may be made on this sand bag to support the rifle by pressing with the hand, and the rifle should be placed therein, so as to be equally balanced.

AIMING DRILL.



correct, he should order the men under instruction, in succession, to observe the position of the rifle, with reference to the object aimed at, without touching the rifle, and closing the left eye, to observe that it is properly laid or pointed; and, afterwards, he should fold down the elevating or back sight on the barrel, desiring the men to look again along the barrel, in order that they may form an idea of the amount of elevation that was required to attain the range named.

If the instructor find that the aim is not correct, he should, occasionally, not rectify any error in it himself, but call on the men under instruction to examine the pointing of the rifle, and to show and explain the error and its cause.

The instructor should teach the soldier the manner of observation by means of the sights. If the front sight be taken *full*, the muzzle of the piece will naturally be more raised than if the front sight be taken *small*, and a corresponding elevation or depression of the ball above or below the point-blank will occur, depending on whether the front sight be taken "full" or "small." By taking the front sight "full" is meant, that the soldier can observe the whole of the front sight; by taking it "small" is meant that he only sees the top of it.

The instructor should also see that the front and back sights are perfectly vertical or upright; not inclining either to the right or left: since, if they should incline to the right or to the left, the trajectory and line of vision will not lie in the same vertical or upright plane, and consequently will not intersect each other, and the ball will consequently not strike the object aimed at. It seems to be understood, (at least in the lower ranges marked on the scale of the sights,) that either an elevation or depression of two feet on the face of the target, will make a difference of about thirty yards in the extent of range.

This practice of taking aim should be continued for a sufficient length of time to render the soldier perfectly conversant with the various sights, and competent to take aim correctly. When this shall have been accomplished, the soldier must go through the same exercise with the rifle held to his shoulder, instead of being placed on a rest.

For this purpose he must be carefully taught by the

instructor the mode of holding the rifle, so as to ensure its being quite steady, and the mode of pressing the trigger, so as not to occasion any change of position of the rifle in firing.

The rifle should be held by the left hand, placed so far forward as not to occasion any inconvenience in the posture; the further the hand is extended the more equal will be the comparative leverage or balance of the rifle on either side of the hand; and the greater will be the facility of holding it perfectly steady. A pressure towards the shoulder will be exerted by the left hand, which will also contribute to the steadying of the rifle. The right hand will hold the rifle, clasping it below the trigger guard, and will press the butt firmly to the shoulder, being assisted in steadying the rifle by the inner and lower part of the right arm. The first or trigger finger must be placed lightly on the trigger, so that in firing its only motion will be very gradually to press the trigger without the slightest jerk; since if it be placed at any distance from the trigger, the movement towards the trigger for the purpose of pulling it will most probably cause a deviation in the direction of the rifle. The second joint of the first finger should be placed on the trigger, and used to pull it; and the trigger must be pressed by the finger without any jerk or movement of the elbow.

The instructor may teach the mode of pulling the trigger thus:—

1. Place finger on trigger.
2. Stop breathing.
3. Pull trigger gradually, so as not to know when the cock will fall.

A very important point to be observed is, that from the moment of finally taking aim until after the firing, the breathing should be stopped; so that the motion of the chest in taking breath do not change the position of the rifle.

For the purpose of taking aim the head should be inclined or leaned down a little to the right, so as to bring the right eye immediately over the back sight; and in a line with the sight at the muzzle of the barrel. Aim must be taken with the right eye, the left eye being closed.

In order to enable the instructor to determine the pre-

cision of aim achieved by the soldier, during this process of preliminary instruction of firing from the shoulder, the instructor, placing himself about ten or twelve yards in front of the soldier, and telling him to aim at his right eye, will be able to ascertain if the soldier has acquired the necessary requisites for aiming correctly.

The next point will be to practise the soldier in taking aim at an object at any assigned distance ; and as to this the duties of the instructor must necessarily be confined to seeing that the proper sights are used, that the rifle is held in the proper position, and that the trigger finger is so placed and used, as not to cause a deviation from the line of aim.

The back sight is, as has been stated, graduated or marked with various numbers corresponding to distances, from 100 up to 500 yards.

In directing the rifle at any object less than 100 yards, if the sight for 100 yards be used, it will be necessary to make allowance for the difference, and to aim proportionably below the object ; and so if the 200 yard sight should be used for an object at less than that distance. But if the 100 yard sight be used for an object beyond that distance, an aim proportionably above the object must be taken, and so for the 200 yard sight, if it be used for an object beyond it, and equally so with the other sights up to the 500 yard sight. With reference to the sights from 500 to 900 yards, the shifting slide will enable the soldier to adjust the elevation pretty accurately.

The point of an object at which aim should be taken, if it be at point-blank range, is the centre ; if it be near, but within point-blank range, the lower part ; and if near, but without point-blank range, the upper part.

In this first part of the practice of firing from the shoulder, the trigger is of course to be pulled so that the cock will fall ; but in this case, precaution must be taken by placing a small piece of leather, or india-rubber, on the nipple, that the cock be not broken in falling on the nipple, in the absence of the cap.

The next course of practice will be with caps ; which will in most points be but a repetition of the preceding ; but in order to ascertain that the men aim correctly, a lighted candle may be placed at some short distance from the muzzle

of the rifle, which, in the event of the aim being precise, will generally be extinguished.*

This preliminary practice will be followed by firing with blank cartridge, and subsequently with ball.

In ball firing, care must be taken by the officer that, so far as he can control it, no portion of the powder in the cartridge should be lost; and the men must, therefore, be charged to be particularly careful when biting off the end of the cartridge, not to suffer any portion of the powder to be wasted; since all difference in the quantity of powder will make a corresponding difference in the range of the rifle: the cartridges being carefully prepared in relation to the sights on the rifles.

In ball firing, the soldier must begin to aim below the object to be hit, and gradually raise the muzzle of the rifle in a straight line up to the object (or bull's eye), and at that instant the trigger should be pressed, and the piece discharged, for the following reason:—As long as you preserve the vertical or upright motion, no lateral motion can take place;

* Since the first edition of this work was published, we have had brought under our notice a report of Lieut.-Colonel A. Lane Fox, the Chief Instructor of Musketry at Malta, showing the difference of firing of the 1st and 17th Companies of Royal Engineers before and after preliminary instructions in firing, which goes to prove the necessity and advantage of the preliminary instruction which we had strongly urged.

A copy of one of the returns to this Report we give below:

“ St. George's Rifle Range,

“ Malta, 23rd May, 1857.

“ I AM given to understand that, previous to the commencement of the present course, the men of these companies had hardly ever fired with the old muskets, and never with the rifle, their duties as Engineers having interfered to prevent much attention being paid to this branch; such, indeed, appears evident from the return marked A, annexed to this Report, showing the practice with four rounds, which, in conformity with the custom of this Station, was fired on the first arrival of the detachment at the practice-ground before instructions, and four rounds fired at the same distance immediately after preliminary training, the intermediate time being occupied in preliminary drills with theory and sham-firing with copper caps; the improvement, amounting to nearly three to one, is, therefore, due to these drills alone, unassisted by actual practice with ball cartridge.”

A.

A Return of two Companies of the Corps of Royal Engineers under Instruction at St. George's Rifle Ranges, showing their practice with four rounds per Man at 300 yards, before and after preliminary practice.

Comparisons.	Sections.	Before preliminary Instructions.				After preliminary Instructions.			
		Men.	Rounds per Man.	Points.	Average.	Men.	Rounds per Man.	Points.	Average.
1	1	22	4	13	0.59	22	4	64	2.90
"	2	20	"	33	1.65	20	"	77	3.55
"	3	20	"	16	0.80	20	"	51	2.55
"	4	22	"	20	0.90	22	"	60	2.72
17	1	23	"	16	0.69	23	"	62	2.69
"	2	22	"	15	0.68	22	"	45	2.04
"	3	17	"	20	1.17	17	"	58	3.41
"	4	21	"	23	1.09	21	"	65	3.09
...	...	167	...	156	0.93*	167	...	482	2.88*

* These figures in the two columns under the head of average points, show the merit of the practice before and after preliminary instruction.

N.B.—These two Companies were armed with the Lancaster Carbine.

(Signed) A. LANE FOX, B.-Major, Gren. Guards,
Chief Instructor of Musketry.

but if your aim be taken at the object to be struck for any length of time, say a few seconds only, your musket or rifle would, by involuntary movement, form a circle round the object to be struck.

In the first period of ball practice, it would be well to place a target of eight feet diameter at a short distance, say fifty yards, in order to give confidence to the men, and to detect more easily their incompetence in taking precise aim; and it would be advisable to continue the practice with this target until they have acquired a certain proficiency.

Such of them as shall fail to any considerable extent in firing with tolerable accuracy, should not be permitted to continue ball practice, but should go back to the preliminary drill of aiming, and not be allowed to resume the ball firing until they should have proved themselves more competent.

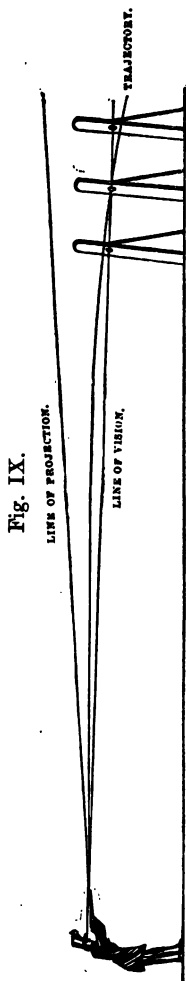
Such as shall succeed to any fair extent may be formed into separate squads or classes, according to merit.

This will excite emulation among the men by a desire to be ranked in the higher classes, and by finding in their respective classes competitors of equal skill with themselves.

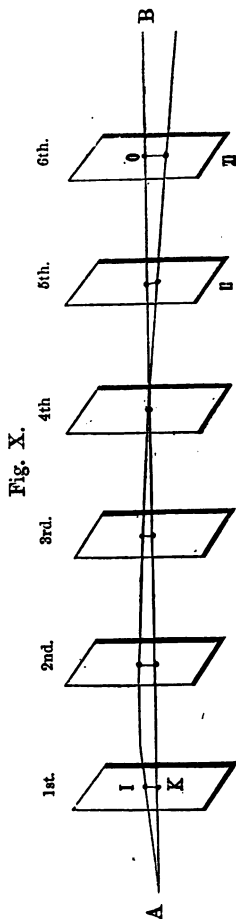
Prizes may also with good effect be given to the most able at stated periods.

This practice may be varied by the men firing sometimes from the knee, and sometimes standing.

After the men have shown a tolerable proficiency in firing at this first target, it would be well to place a second target at a certain distance—say 30 or 40 yards behind it, as in fig. X. The ball, having passed through the first target, would then pass through the second target at a higher or lower point, and would thus afford a means of



showing practically, and explaining to the men the line of projection, the trajectory, and the line of vision.



So soon as the firing at this first target should have acquired something like perfection, the distance may be increased, and targets of the ordinary dimensions of 6 feet by 2 may be used. They should be painted black or white, according to the colour of the object opposed to them, with a white* or black spot, or bull's eye of 6 inches in diameter, in the centre. They should be divided into three squares by two horizontal lines. These divisions are called the upper, the centre, and lower divisions of the target.

Up to 225 yards, the practice will be at a single target.

From 225 to 300,	at two,
325 to 400,	at three,
425 to 500,	at four,
600	at five,
700	at six,
800	at eight,
900	at ten,
1,000	at twelve,
1,100	at fourteen targets,

the targets being placed very near together.

Besides the firing singly at the target, soldiers should be exercised in firing by files, firing in volleys, and in skirmishing order, &c. &c. This will accustom them to the inconvenience of their comrades' fire and movements, to the smoke from their rifles, and to quick obedience to the word of command.

The firing by volleys and by files on targets, which will show the effects of the fire, is necessary,

* The white bull's eye has been the origin of the term "point-blank," which is only a corruption of the original French "point-blanc" — i. e. white point.

since it will afford officers the means of knowing such effects at various distances, and of thus rendering them competent to command in corresponding circumstances.

It may be observed, that the ranges are marked on the scale of the back sight, in the supposition that the sights have in every instance been placed with perfect accuracy ; but the soldier will be prepared to discover some peculiarity in his own musket or rifle, for which allowance must be made ; and he must not be discouraged if even, having found a means of remedying its defects, he does not always hit the mark, or make equally good practice. There are various causes, to be more particularly detailed hereafter, which may operate against him, but for which, when he becomes sufficiently experienced, he will be able to make due allowance, so as to reduce or counteract their effects.

If from these, or any other causes, he should not arrive at perfection so soon as he may desire, or should be detained, or even sent back by his commanding officer to the preliminary practice of learning to aim, he may be perfectly convinced that his own interests demand such a course, even more imperiously than the interests of the service ; since a soldier may not unfrequently be placed in circumstances where his skill, and that coolness which is the result of confidence in his skill, may be the means of acquiring for himself honour and promotion, if not of saving his life.

CHAPTER VI.

ESTIMATION OF DISTANCES.

WE have considered the principles and practice of firing, but it will easily be conceived that, how important soever these may be, and certainly are, the just appreciation or estimation of distances at which the object fired at may be, is of equal or even of greater importance. It is impossible, indeed, to bring into effect the rules already laid down, if the soldier cannot pretty accurately judge as to the distance of the object which he has to strike ; the rules for firing at such or such a distance, having reference only to the prescribed distance.

Continued trials and frequent observation can alone confer

a habit of judging of distances, and that readiness and quickness in deciding on them, which are absolutely essential to make an expert marksman.

In firing at the target, or otherwise simply for practice, the distances are measured and well known, and nothing is required but to aim correctly, and to fire with care and attention to the rules prescribed ; but when the soldier is opposed to an enemy, the distance is necessarily unknown, and it is absolutely essential to decide with promptitude, and as exactly as possible, the distance ; and to regulate the firing accordingly.

The estimation of distances is made either by simply judging of them by sight, or by the aid of instruments.

We shall first consider the means of acquiring facility of judging of distances simply by sight.

The men who are to be instructed should have all their arms and equipments complete, except the knapsack.

A distance, say of 200 yards, will be measured off by a chain, and divided by some marks, such as small sticks stuck in the ground, small stones, or scratches made in the ground, into distances of 50, 100, 150, and 200 yards. The men under instruction will then be made to pace this ground so marked, stepping in their ordinary manner, without increasing or lessening their usual mode of stepping. They will be directed to count the number of paces in each 50 yards, and to continue this until they shall have attained an equal number of paces in each 50 yards. They will take the same course as to 100 yards.

These operations must be repeated as often as may be necessary to teach each soldier the number of his paces in one yard.

In order that the soldier may have the means of remembering the number of yards he passes over, it would be well that he take some means to mark such number, without having to trust to memory.

He may, for example, when he has passed over 100 yards, turn down the thumb of his right hand ; when he has passed over a second 100 yards, turn down the first finger of his right hand ; and so on up to 500 yards.

If he want to remember the number of single yards, he may turn down the thumb of his left hand for the first yard, his first finger of left hand for the second yard, and so on ; or he may place a finger on the buttons of his jacket succes-

sively, on the right side to count the 100 yards, and on the left side to count the single yards; or he may adopt any other mode that may be convenient to his memory.

When this shall have been accomplished, the men will begin again at the commencement of the 200 yards, and pace over the whole distance, until they shall be able to pace the 200 yards in double the number of paces they took for 100 yards.

When they shall be proficient in this, they will leave the ground that has been measured off, and go to another ground, and there pace 25, 50, 100, 150, and 200 yards; until they shall have acquired a complete facility in pacing any distance within 200 yards. They will mark the distances they pace on this unmeasured ground, and they will be checked by the instructor measuring with the chain; and this exercise they will continue until they are quite competent to pace any assigned distance, less than 200 yards, correctly.

In all these exercises there must be placed at the point from which the soldier departs some mark sufficiently conspicuous to be seen by him after he has paced the several distances, so as to enable him, on turning round, to observe his distance from such point.

This having been accomplished, the instructor will form his detachment, in rank at that end of the 200 yards at which the measuring was commenced; so that the measured line shall be perpendicular to the front of the detachment, one end being at the middle of the line. He will order four men of the detachment to go, one to 50 yards, another to 100 yards, another to 150 yards, and the other to 200 yards, and to front the company.

He should order on this service men of the ordinary height and size, who have no peculiarity of dress, nor anything to attract particular attention. These men should carry their ordinary arms and equipments. The instructor should cause the men at drill, placed in rank, to observe the various parts of each of the men sent out, his dress, arms, and equipments, and point out to the men at drill that certain parts of the men's dress, &c., which are distinctly visible at 50 yards, are either not so clearly visible, or are reduced in apparent size, at 100 yards; that they are still less clearly visible, or more apparently reduced, at 150 yards; and so on.

To facilitate this instruction, the following table of observations will be of material service to the officer, and ought to be learned by the men, so as to be of use at the moment of need :—

TABLE OF OBSERVATIONS

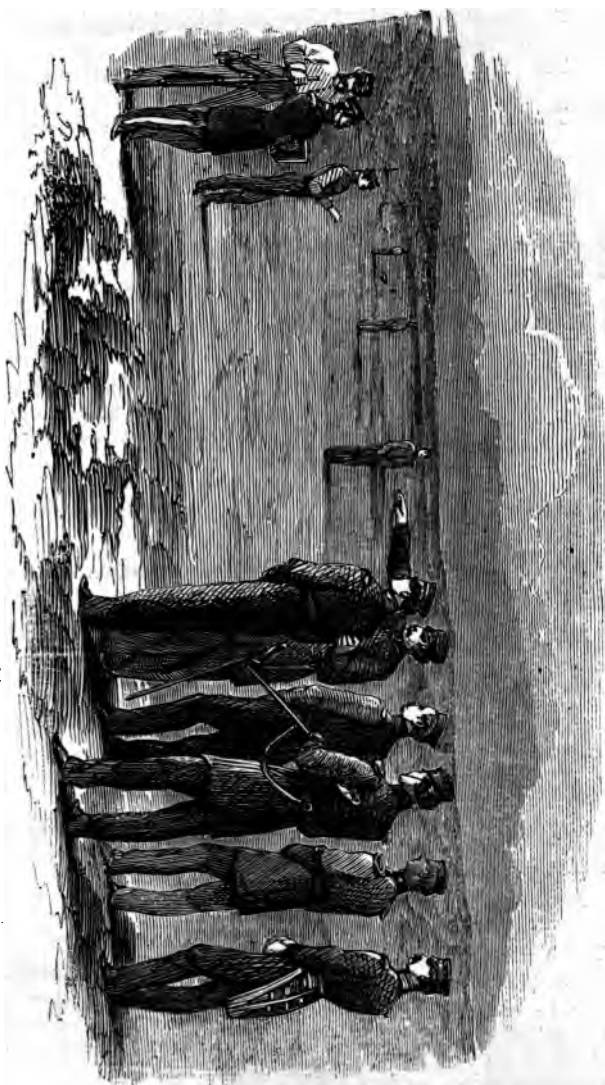
OF the order in which different parts of the body of a soldier, and of his equipment, and his movements disappear, successively, according to the increase of distance. .

These observations must be taken only as approximative, and will be liable to modification, according to the length of sight, and power of sight of the observer, the state of the light and atmosphere, the time of day, the form of the country, &c. &c.

CAVALRY.

150 to 250 yards.	}	The face, but not the features of the man.
250.		The cuirass seen sideways.
	}	The bridle of black and bay horses seen sideways.
300.		The blade of the sabre, unsheathed, seen in front or rear.
	}	The carbine of dragoon, slung.
		The bridle of gray horses seen sideways.
		The blade of sabre seen sideways.
		The sheath of sabre seen on left side.
400.	}	The form of chako.
		Red epaulettes.
		The staff of lance.
500.		The cross or waist belt seen in front.
	}	The helmet of dragoon, the man being seen in front.
600.		The facings on the breast, of a yellow colour.
At this distance, black horses cannot be distinguished from bay.		
	}	The cross or waist belt seen from behind.
		The cuirass seen in front.
700.		The tufts, or feathers, and facings on the breast, of a red colour.
		The pace of horse.

JUDGING DISTANCE WELL.



At this distance, the front cannot be distinguished from the back of the horse.

The lighter coloured horses cannot be distinguished from the darker.

The saddled horses cannot be distinguished from the unsaddled.

800.	{	The cuirass seen from behind.
	{	White facings on the breast.
	{	The trot and walk of horse.
900 to 1,000.		The horse trotting or galloping.
1,100 to	{	The movement of horse in gallop.
1,200.	{	
1,200.		The helmet of dragoon seen sideways.
1,500.		The flags of lancers.

Note.—The movements of horses apply only to horses coming towards, or going from the observer. When horses are seen sideways, their movements are distinguishable at much greater distances.

INFANTRY.

About 150 yards.	{	Green epaulettes.
175 to 200.		Face of soldier, and white epaulettes.
250.		The knapsack.
300.	{	The hands, row of buttons, clasp or plate on belt, and ornament on chako, knapsack of dark colour, hilt of sword.
	{	
350 to 400.		Red epaulettes.
450.	{	Bright barrels of muskets, arms carried on shoulder, and general dress.
	{	
500.		The march of soldiers approaching or retiring.
600.		The movement of arms.
700 to 750.	{	Movement of columns in march advancing or retiring.
	{	
1,300.		Red trowsers.

Note.—The march of columns, presenting their flank, may be seen at much greater distances.

The instructor will then ask each man at drill, separately, what are his observations on these several points, and will explain to him the effects produced to the eye by objects viewed at different distances; thus it will be pointed out to him that at 50 yards the features of the man, the buttons on his jacket, the band and number on his foraging cap, can

be plainly recognised ; while at 100 yards the lineaments can no longer be discerned, the buttons seem to form a continuous line, the number is scarcely separable from the band ; and at 150 yards the face looks like a whitish ball under the line of the cap.

He will question his men separately, and must be prepared to find a difference of statement between them, arising from a difference in their length of sight and power of sight.

The better course to take will, perhaps, be that the instructor shall commence his instruction by stating in detail the parts of the person and equipment that are visible plainly at 50 yards, and go through a course of drill on this point at such distance ; and, when the men are perfect in their knowledge of all the facts at 50 yards, then that the instructor shall state in detail the parts of the person and equipment plainly visible at 100 yards, and go through a course of drill as to that distance, and so on, successively, at each greater distance.

The instructor should point out to the men the differences existing between the parts visible at 50 yards and 100 yards, and so for greater distances, taking care to make the men observe the greater or less distinctness with which the same parts are visible at different distances.

The instructor should make the men observe, that the same man sent out appears to get smaller and smaller as he goes to a greater distance, although his actual size must of course be the same.

It will be indispensable that he shall point out to the men that in foggy or cloudy weather, objects having much less light falling on them, appear much more distant than they really are ; and that in clear, sunshiny days, being much more lighted, the details are much more easily visible, the object appearing nearer than it is in reality. In an avenue of trees, objects appear, from the effects of perspective, much more distant than they really are ; and the absence or contiguity of other objects, the state of the atmosphere, and the effects of light and shade, may apparently increase or diminish the distance in many cases. For instance, a man placed on an elevated ground, and having only the sky visible beyond him, will appear much higher and larger, and consequently nearer, than he would under other circumstances, and this apparent height and

size will be again modified by the state of the atmosphere, the state of the light, &c. &c.

Again, a man placed before any high building, high tree, &c., will appear smaller and more distant than he would appear under other circumstances.

When the men shall have been sufficiently drilled in this estimation of distance, the instructor will change their position to some unmeasured ground, and send a soldier armed and equipped as before, and as near as may be of the same height and figure as one of the four men already employed, to some distance which shall be determined by desiring him to halt. At this distance he is to turn and face the company; the instructor will then command the men in rank to observe the man so sent out, and to estimate his distance, bearing in mind the observations they have already made on the four men, placed previously at certain known distances.

Having done this, he will call each man separately out of the ranks, and, making him speak in a low tone of voice, he will question him as to the distance, and as to his reasons for the opinion that he has formed; and the instructor will make a note of the distance assigned by each soldier.

The instructor will then cause each man to pace the distance, and will take a note of each man's measurement, and he will finally verify the measurement by the chain.

After this verification, the instructor will read the statement of each of the men aloud, and will make such observations on them to the men, generally, as will lead to a more just estimate of the distance on any future trial.

The instructor must repeat this exercise continually until the men can pretty accurately judge of all distances not exceeding 200 yards; taking for each exercise a different ground, having, if possible, a difference of surrounding objects and colours, and a different conformation. Thus he should sometimes choose ground rising from the men, sometimes ground declining from them; sometimes even, sometimes uneven ground; sometimes ground overgrown, or studded with bushes; sometimes open ground, sometimes ground thickly grown with trees; sometimes hilly ground, sometimes plain; sometimes ground having buildings on it, and so forth. These drills should also take place in different states of the atmosphere; at various parts of

the day, morning and evening, and with different effects of light and shade. They should also be made with the sun in front, and behind the men, and in other positions as regards the sun.

In these drills also selections may be made of the most competent men ; and they may be formed into various classes, according to merit.

When the instructor shall consider that his men know how to estimate, with sufficient accuracy, the distances included within 200 yards, he will proceed to the estimation of distances between 200 yards and 400 yards. With this view, he will measure with the chain a distance of 400 yards, and mark on the measured line distances of 200, 250, 300, 350, and 400 yards. The detachment being in line, he will order five men to take up positions as before, at each of these distances, the first at 200 yards, the second at 250 yards, and so on, and then to face the line.

He will then go through the same course as he already did for the previous distances ; but in this case, the measured point of 200 yards will be the term of comparison for the longer distances. When the men are sufficiently capable of thus judging of these greater distances by the five men so placed, the instructor will take the same means by sending only one man to some uncertain distance, at which he will be made to halt as before, and precisely the same means will be taken to perfect the men in judging of the longer distances up to 400 yards.

After 400 yards, the distances will no longer be marked by single men sent out to certain distances, but by detachments. The distances up to 900 or 1,000 yards will be measured in the first instance as before, and the observations will be made on the distances between 400 and 900 yards.

After having been sufficiently drilled in these distances by the detachments so placed, a party composed of a corporal, a bugle-man or drummer, and two men fully equipped, will leave the company, and march to some uncertain distance, to be assigned by the instructor as before, by his commanding the party to halt after having passed the distance of 200 yards. The corporal will then place the three men in rank, about a yard asunder, facing the company, and resting on their arms ; he will take his position at the right.

The instructor will then cause the exact distance to be measured. During the whole of this operation, the company

will be made to face right about, so as to have their backs turned to the party sent forward.

The instructor will then require the officers and non-commissioned officers to compute the distance, each one separately. He will then ascertain from each (without being heard by the others) his computation, and will correct it by informing each of the actual distance.

The officers and non-commissioned officers will then, having made the men face right about, so as to see the party, question each man separately as to his computation of the distance, making each come separately out of the ranks, so as not to be heard by the others. If wrong, they will order him to re-consider the computation, and will note each man's computation on a paper.

So soon as the majority of the company shall have made a computation near the distance, the instructor will order the ground to be again measured before the men. At each distance of 10 yards beyond 200, a signal, to be agreed on, will be given by the bugleman or drummer to the company, and they will be allowed time to appreciate the distance by observing the measuring party, at the distance at which such party shall then be found.

When the distance shall have been accurately measured, the corporal with his party will advance, and take up a more distant position, with the same precaution of not being seen by the company as before ; and the same course of computation of this increased distance, and the same mode of drill, will be gone through as was done for the lesser distance ; the men in this case being required to compute not only the distance from the point first taken up, and the increased distance, but also the whole distance between the company and the increased distance.

It will be necessary in drilling, for the estimation of the greater distances, to send out occasionally bodies of men, since at distances exceeding 700 yards most of the separate parts of the equipment will, under ordinary circumstances, have become invisible, or be but very indistinctly seen.

These several exercises will be followed out, until the men are capable of accurately computing distances with promptitude,—simply by sight.

There are, however, methods of computing distances by instruments ; but which will not in service be generally practicable.

The importance, therefore, of estimating distances by sight cannot be too much insisted on ; nor can too much attention be paid to it.

Measuring distances by instruments.—The measuring of distances by instruments, is founded on the principle that in proportion to the greater distance, the size of the object is relatively diminished. Thus it will have become known, in the course of drill recommended, that the men, sent out to different distances, have appeared to be smaller in proportion to the greater distance to which they have been sent out. Now, experience has shown that at 325 yards, an object has an apparent size of about one-third only of its actual size ; at 435 yards, about one quarter only ; at 545 yards, about one-fifth only. It may easily be understood, then, that if we know the actual height of an object, we may, by comparing its apparent height, at any distance unascertained, with its real height, arrive at the knowledge of its distance.

Now, suppose we would determine the distance from us of an infantry, or a cavalry soldier. The average actual height of an infantry soldier, with his chako, is about six feet, and that of a mounted trooper, about eight feet ; if we then can ascertain his apparent height, we shall, by comparing it with the known diminished height at any given distance, be enabled to ascertain his distance from us. Thus, for instance, we find that the apparent height of an infantry soldier, at some unascertained distance from us, is about two feet, and knowing that at 325 yards the apparent height of an object is only the one-third of its actual height, and that the actual height of the soldier is six feet, we are enabled to conclude that his distance from us is about 325 yards.

For all the practical purposes in rifle firing this approximation is sufficiently near. We have then to arrive at some means of finding the apparent height of the soldier.

Now, to this end there are various means by the use of instruments ; but as in practice it is necessary to adopt some easy mode, and very extreme precision is not requisite, a rough plan has been adopted of arriving at the desired conclusions.

A rule, having on each side marked the inches, from one inch to three or four feet, and on one side a scale of the distances corresponding to the apparent height of a horseman, and on the other, a similar scale, corresponding to the apparent height of an infantry soldier, is held in the right hand,

at arm's length, and in a line with the right eye, and placed vertically or upright, so that the number of inches and the corresponding degree of the scale of distances may be read off. The observer's head being kept perfectly steady and the left eye closed, a sight will be taken, and the upper part of the rule will be applied to the top of the object; for instance, the chako of the infantry soldier; the thumb of the right hand will then be made to slide down the rule, until it comes to the point where, another sight being taken, the thumb will appear to be on a level with his feet. The part of the rule between the top and the thumb will then indicate the apparent height of the soldier, and on the corresponding scale will be found the distance.

For this mode of measuring distance, the rule must always be held at the same distance from the eye.

This is a rough mode of estimation, but will generally be found to be sufficiently accurate for all practical purposes, not exceeding 200 yards distance. This rule may easily be made by any one who may find it necessary.

Another rough mode of judging of distances, the instrument for which is always in the hands of the soldier—his own rifle—has suggested itself to us, and which we shall, by way of distinction, call

THACKERAY'S STADIUM.

We propose to substitute the rifle, or rather the bayonet of the rifle, for the rule above mentioned.

In order that the bayonet may always be held at the same distance from the eye, which we have seen to be essential in such a mode of measuring distances, let the soldier place his left foot square, and take one step with his right foot forward, to the extent, as nearly as may be, of twelve inches; let him place the heel-plate of his rifle firmly on the ground, touching the point of his right toe, the musket being placed so as to place the shank, or foot of the bayonet, parallel with his front.

Having ascertained by a sufficient number of experiments what would be the apparent height of an object placed at any given distance, as shown by his bayonet, let his bayonet, if need be, be slightly marked with a file, as a graduated scale for showing distances of 100, 200 yards, &c.; this being done pretty accurately, he would, by this use of his bayonet, be for all practical purposes enabled to judge sufficiently

nearly of distances, and would correct or aid his judgment formed from mere sight.

But there is a stadium which is a more scientific instrument, and which, being simple and easy of application, is generally used.

We do not, however, consider it necessary to the objects we have in view in this work to enter into any details of the instruments for judging distances, their use being generally confined to field officers.

It is most important that soldiers should be accustomed to judge of distances correctly ; that they should know what is the distance of the point-blank range marked by the back-sight of their rifle, what is the exact degree of elevation that is required in order to hit objects at different distances within and beyond that point-blank range. They should, therefore, be trained to a knowledge of distances on every kind of ground, and be at all times prepared to answer correctly the following simple questions :—

1st. What is the point-blank range marked by the back-sight of your rifle at this moment ?

2nd. What elevation is necessary to strike an object at a less distance than the point-blank range, and should such elevation be greater or less than that for the present point-blank range ?

3rd. What elevation is necessary to strike an object at a greater distance than the point-blank range, and should such elevation be greater or less than that for the present point-blank range ?

4th. Does your rifle carry to the right or to the left ?

5th. How many yards are you distant from such an object ?

6th. Show by your rifle what is the requisite degree of elevation in order to enable you to hit the body of an infantry soldier at 200, 250, 300 yards, &c., and so on.

7th. To hit a cavalry soldier at the same distances.

Officers should more especially be enabled to judge of distances, and should be unremitting in their drill to this end, since, as they are called on to command the fire on an enemy, they ought to have the faculty of rapidly judging of distances.

There is another essential point connected with distances, to which it is necessary to direct particular attention, which is the firing at an object in motion.

A foot soldier gets over in a minute at quick march about 72 yards, at the pace of a charge about 88 yards. A horse walks over about 433 yards in $4\frac{1}{4}$ minutes, trots over the same distance in about two minutes, and gallops over the same distance in about one minute.

A foot soldier occupies in rank a width of about 2 feet ; a trooper about 3 feet.

Now, suppose that a cavalry soldier be moving to or from the point of the line of vision, which is at point-blank range ; it is clear that if the rifle be fired to strike at point-blank range, the ball will either fall short of, or go beyond the cavalry soldier by the distance that will be passed by him, during the time taken in the flight of the ball. Allowance must therefore, in such circumstances, be made for this distance.

Suppose him to be coming nearer, in a direction perpendicular to the plane of projection, and to be at the point of point-blank range when aimed at, allowance must be made for his being somewhat nearer when the ball shall reach him, and an aim must be taken accordingly below the line of vision, or, in other words, at the feet of the horse. By such means, as the ball rises in the trajectory, within point-blank range, the ball would strike the head of the horse or the rider.

Suppose, on the other hand, the cavalry soldier be riding away in the same plane of projection, allowance must be made for his being more distant when the ball reaches him, and an aim must then be taken above the line of vision, or, in other words, at the head of the cavalry soldier ; and since, as the trajectory falls below the point-blank range after it has passed it, the ball would strike the body of the horse or the rider in such case.

Allowance must also be made in case of his moving to the right or to the left ; but as in this case his distance would be nearly the same, it will only be necessary to direct the rifle to the right or left, so as to compensate the probable distance in either of such directions that he may pass over.

It is impossible to give precise rules for all the circumstances of objects in motion ; but we may afford some indication that may be useful as regards cavalry moving from right to left, or *vice versa*.

When horse is walking—

At 100 yards,	aim at horse's shoulders.
" 200 "	" " nostrils.
" 300 "	" " about $2\frac{1}{2}$ feet before head.
" 400 "	" " $5\frac{1}{2}$ " " "
" 500 "	" " 9 " " "
" 600 "	" " $13\frac{1}{2}$ " " "

When trotting—

At 100 yards,	aim at head.
" 200 "	" " $4\frac{1}{2}$ feet before head.
" 300 "	" " $9\frac{1}{2}$ " " "
" 400 "	" " 16 " " "
" 500 "	" " 24 " " "
" 600 "	" " 34 " " "

When galloping—

At 100 yards,	aim 3 feet before head.
" 200 "	" " 12 " " "
" 300 "	" " $22\frac{1}{2}$ " " "
" 400 "	" " 36 " " "
" 500 "	" " 52 " " "
" 600 "	" " 75 " " "

In being engaged with an enemy, it will always be desirable, in estimating the distance, to fire the first round rather before than beyond him, since this will lead to a more just appreciation of the distance than could be obtained by firing beyond him; besides which, there would be the chance that the fire would not be thrown away, since the ricochet or bound of the ball may do him as serious an injury as a fire directed exactly into his ranks.

The just appreciation of distance is, we repeat, of the highest importance. Well skilled in this, the soldier seldom throws away a shot; and this has a double effect,—the saving his ammunition, and the intimidation and destruction of the enemy. The value of his ammunition can never be too highly estimated, since nothing inspires more confidence in him than that he has a cartouch box well provided against every emergency. One single charge of ammunition may be the means, under a variety of circumstances, of saving his life, or of turning the tide of victory in his favour. The effect, too, of a well-directed fire on an enemy is not confined simply to his destruction; it distracts him, and throws him into disorder, and nothing makes so strong an impression on him as the having his ranks thinned by every discharge,

whilst, on the other hand, it tends to animate and encourage the troops who are opposed to the enemy, and opens to them the chances of victory, not only by the cutting up the enemy's ranks, but by introducing among them that fear of the skill and coolness of their opponents, which has a great moral influence in favour of the latter. Nothing, moreover, affords so favourable an opportunity for a successful charge as the effects produced by a steady and well-directed fire. On the other hand, a hasty and ill-directed fire leads an enemy to hold his opponents in contempt, and creates in him such confidence as, once felt, seldom quits him during the combat.

CHAPTER VII.

FIRING AT UNKNOWN DISTANCES, OR AT MOVING OBJECTS.

ALTHOUGH, as a means of acquiring skill in the use of the rifle, and of judging readily of distances, strict attention must be paid to the course of drill previously recommended, yet for practical purposes before an enemy the soldier will still have to acquire facility in firing at unknown distances and at moving objects. To this end much must be left to the ingenuity of the instructor in providing means to take his men unprepared; he may, for example, march them through a wood, or over ground concealing the targets or objects, and opening suddenly upon them may order his men to fire in a body without using the sights on the rifles; and when they have so fired, before leaving their position, may examine them as to their judgment of the distance. He may, after himself privately deciding on an object, march them to or from it, and, making them suddenly halt, order them at once to fire. He may show them an object, and afterwards march them in various directions, making them suddenly halt as before.

He may march them up a hill, and, on arriving at the summit, order them to fire. In fine, he may contrive many means to take his men unprepared, and thus make them skilful in judging distances at the moment without using the sights on the rifles.

A course of drill in firing at objects in motion, without

using the sights on the rifles, will also be necessary. To this end it has been suggested to provide movable targets to be put in motion by a rope and windlass, giving varieties of motion, as nearly as may be, corresponding with that of horse and foot soldiers, and causing the targets to advance, recede, go to the right, the left, &c. &c.

Various other modes of putting a body in motion, to be fired at, may be easily devised.

CHAPTER VIII.

FIRING IN SKIRMISHING ORDER AND IN LINE.

AS the Volunteer force has been created since the former edition of this work, it may be as well to add some observations on firing as skirmishers and by files.

The firing in skirmishing order will be supposed to be directed—

1st. Against the enemy's skirmishers.

2nd. Against the enemy in line or column.

The skirmishers will fire when marching ; they will march forwards from a line drawn on the ground, and, when they have fired one-half of the cartridges allotted for this practice, will fall back, firing as they retreat.

For the practice relating to fire against an enemy's skirmishers, common targets will be used, placed at about 15 or 20 feet apart, according to the distance from the men, and at such distance as the instructor shall order.

For practice relating to fire against an enemy in line or column, a number of common targets, proportioned to the party under instruction, will be placed side by side touching each other.

The distance at which the targets will be placed from the firing party is not to be known to the men, or the officers, and is to be judged of by the men themselves, as they would of the distance of an enemy.

The targets are to be examined after the firing to ascertain the effects, and appreciate the precision, of the fire, and the instructor will make such observations to the men thereon as the case may require.

As to the firing in line, common targets are placed, proportioned in number to the firing party, side by side, so as to form a supposed enemy's line, and at distances unknown to the firing party; and the men are made to change their position in line so as to practise them in the various positions.

The word of command is given by the officers, who know the distance from the enemy, and a sufficient time ought to be allowed between the words of command—"Make ready!" and "Present!"—to enable the men to take accurate aim; or a time, in which the officer in command can count 1, 2, 3, 4 (about four seconds), will be a proper interval to elapse between the two syllables of the word "present"—viz., "pre"—"sent." This is essential, also, to prevent the men hastily pulling the trigger, and thus throwing away their fire, which they would do if the word of command were too quickly given. On the other hand, the officer should not allow too long a time to pass between the words of command, since this would be attended with other inconveniences.

The targets are, in this case, to be examined after the fire to ascertain the effects produced.

Before, however, any practice with ball at targets, either as skirmishers or by files, a course of preliminary practice must be gone through with the unloaded musket, so as to teach the men these operations thoroughly, and, after the unloaded musket, the usual course of snapping caps and firing blank cartridge must precede ball practice.

CHAPTER IX.

CAUSES OF DEVIATION IN FIRING, AND THEIR REMEDIES.

THERE are several causes which may produce a failure or imperfection in firing.

First. Because of ignorance of the principles of firing, and of the necessary management of the rifle.

Secondly. Because the ball may, and generally does, suffer deviations from the leaving the rifle in its passage through the air.

The first class of causes may be materially, if not wholly,

obviated by the attention given by the instructor, and by the practice of the men.

The second class of causes depends on the quality of the rifle, and on external influences operating on the ball. The most expert marksman, and most skilful shot, cannot obviate some of these causes.

The principles we have laid down as to taking aim must be applied with reference to these causes.

The rifles are not always of the same make, nor is the make always regular and perfect, as we have been compelled to assume it to be in laying down general principles.

Sometimes, for instance, the line of vision of the sights on the rifle itself is not exactly in the same vertical plane with the axis of the barrel. It happens, therefore, that an aim taken with the back and front sights would not carry the ball in the vertical plane of the true line of vision. In this case, therefore, the defect in the rifle being ascertained, aim must be taken to the right or left, according as the true line of vision is to the right or left of the plane of projection of the rifle. The distance to be taken to the right or left, must depend on the imperfection of the rifle, and on the distance of the object, a proportionately greater allowance being made for a corresponding greater distance. This, however, is an imperfection that will not generally be found in the rifle to any great extent.

Not only may this defect of the rifle, in popular language "carrying to the right or to the left," exist, but the sights may be found not accurately to correspond with the distances marked. This is a much more common defect, and one very difficult to be avoided. If it depended simply on the imperfection of the front and back sights, it might be corrected without much difficulty, but its principal cause is the difference in the calibre or bore of the rifle, which, though in some cases being almost inappreciable, still exercises very considerable influence, and would require that the sights of each rifle should be mathematically adjusted to suit the calibre or bore.

Every soldier must therefore observe very carefully the effects produced by his rifle, and make a compensation accordingly.

Another cause of deviation in the length of the range, will be found in the difference of cartridges; since with what care soever they may be manufactured, differences will

exist when made on a large scale, either in the quality or quantity of the powder, or in other respects.

Another cause of deviation is the rifle being held not in the vertical plane of the line of vision, but inclined to the right or to the left; these effects are more apparent as the inclination is greater, and the distance of the object is increased; and, therefore, the greater the distance of the object, the greater the necessity of avoiding this cause of deviation.

Another cause of deviation, and which we must again press on our readers, is the change of direction occasioned by pulling the trigger, especially if it pull hard.

To obviate this, we must again propose the necessity of constant practice.

Another cause of deviation will be found in the recoil of the rifle.

This cause, although in general slight, has still an influence; and, after the rifle has become foul from use, a greater influence, probably, than has been heretofore noticed.

We are without means afforded by actual experiment of stating what are the precise effects of the recoil in this respect; but we may venture an opinion, that from a rifle fired from the right shoulder, it would probably throw the deviation of the ball to the right, and would more probably still throw the ball upwards by throwing up the muzzle of the rifle.

A remedy for this deviation, partial, if not entire, may be found in holding the rifle very firmly to the shoulder.

Another cause of deviation, and also of shortening the range of the rifle, is by the fouling after firing a long time.

This may be partially remedied by ramming down a ball tight, and placing above it a wad of chewed paper, also rammed down pretty tight,—this wad, on the rifle being fired, will partially clear away the fouling.

Another cause is the cartridges being injured. Another, the ramming down the cartridge too tight: the cartridge should be rammed well home, but with a moderate force.

The heating a rifle, by long-continued firing, also creates deviation. As the rifle becomes more heated, the ball will have a tendency to rise,* and for this allowance must be made.

* This may probably arise, wholly or in part, from the effect of the recoil already noticed.

The injury to the cartridges from having been a long time in the cartridge pouch ; from their being shaken and injured on a long march ; from the powder becoming damp from the humidity of the atmosphere, rain, or other cause, are also reasons of deviation, which must be particularly attended to.

Amongst the causes of deviation arising from external influences, may be noticed the wind, the temperature, and the humidity or dampness, and the density of the atmosphere ; the position of the sun, and the difference of level between the object and the rifle.

Firstly. The wind.

When the wind is opposite to the direction of the ball, the ball finds a greater resistance in its forward motion than in a calm atmosphere ; and is proportionally lowered.

When the wind is in the same direction as the ball, it increases the velocity of the ball, and the ball is raised proportionally.

When the wind forms an angle with the line of the ball, or, in common language, blows from either side, the ball is carried to the side opposite to the wind ; and more so, if the wind is at right angles, and if the force of the wind is great, and as in other cases already mentioned, the greater the distance of the object, the greater the deviation.

No observations, so far as we have been able to learn, have been made in actual practice on the effect of the wind at given velocities ; and, therefore, each individual must form for himself a rough set of rules to govern him in this respect.

Secondly. The temperature—humidity or dampness—and the density of the atmosphere.

These have an effect on the ball, and occasion deviations in its course. When the temperature is high, the density of the atmosphere is generally less, and the ball will rise, but still in the plane of projection ; a contrary effect takes place at low temperatures, attended with increased density. The humidity of the atmosphere likewise has an effect in retarding the progress of the ball. In dry weather the ball generally progresses more freely, and rises. In summer, for example, a rifle will carry, in a range of 600 yards, nearly 50 yards further than in bad winter weather.

It will be obvious that in all these cases allowance must be made for the rising or falling of the ball above or below the trajectory in its natural or uninfluenced direction.

Thirdly. The position of the sun will operate materially by deceiving the soldier as to the real position of the points of the sights which are placed in the line of vision.

When the sun is to the right, the right part of the front sight is lighted, while the left is in shadow ; a bright spot is also seen on the right side of the sight, which will attract the attention of the man, and which will lead him to think the middle of the sight nearer to the right than it really is ; a contrary effect is produced when the sun is on the left side. The soldier is thus led to direct the sights out of the direct line of vision.

This error is to be avoided by directing the aim a little to the right when the sun is on the right side, and a little to the left when the sun is on the left side.

Fourthly. In giving rules for firing in the former part of this work, we have supposed the line of vision to be horizontal, or deviating but little from a horizontal line.

When the positions of the object and the party firing are not on the same level, the form of the trajectory changes ; and if, in such case, the usual rules are followed scrupulously, the object will not be struck.

When the line of vision is above the visible horizon, the trajectory is less curved, and when below the visible horizon it is more curved.

When an object, therefore, is placed on an elevation, aim must be taken above the object ; and when it is on the ground, lower than the horizon, aim must be taken below it.

In wet weather, the soldier must be very careful to prevent the rain getting into the barrel, lock, or nipple of his piece ; which would have a material effect in causing a deviation, if not of wholly rendering useless his rifle.

CHAPTER X.

GENERAL OBSERVATIONS.

TO give the soldier facility and skill in the art of rifle firing in as short a time, and with as little useless expenditure of ammunition as may be, by teaching him the principles and explaining the practice of taking correct aim and firing, and

the means of accurately estimating distances, has been the object of the former part of this treatise.

On the utility of exercises in firing by infantry, much difference of opinion has hitherto prevailed; but with our present means, we may well, I think, consider the time to have gone by, when it was asserted that not one ball in 1,500 did any damage to an enemy, and that in some campaigns every dead man cost his weight in lead. The want of address of the soldier has been often considered an evil without remedy. Whence has arisen this opinion? The American, the Corsican, the Algerine, the riflemen of the Tyrol, even the Caffre, have performed extraordinary feats of dexterity. And what is to prevent the British infantry soldier, with a rifle of equal or nearly equal excellence, from coming within something like an approachable distance of them? Nothing, but the absence of a knowledge of principles, and a want of practice, and the not having the coolness and self-possession before an enemy, which are felt under ordinary circumstances.

To remedy the former branch of this deficiency, has been the end we have had in view throughout this essay.

We have now, however, to call attention to a point—coolness and self-possession before an enemy—which it is almost useless to enforce on the British soldier after the innumerable instances of courage and daring that are recorded daily. We have only to address ourselves to the intelligence and well-known moral courage of our men. *Nothing is more important in the field than coolness and steadiness.* And whence are these derived? From a confidence by troops that their arms are efficient; that their skill in the use of their arms is unquestionable; and a conviction that they are doing their duty.

We know that any incentive to the courage of our men is unnecessary; all that is required is only so to direct it, that it may not be exerted in vain. With this view, we are confident that we have only to point out to them the great advantages that must result from no haste or precipitancy in firing; from coolly and deliberately taking aim; from so far as possible acting in no more hurried manner, than if no enemy were before them; and from economising their ammunition, and not throwing away a single shot.

Haste and precipitancy are frequently productive of ill results; yet in few situations may they be more so than in

a field of battle. Rapid firing, combined with skill, may be sometimes useful and even necessary ; but rapidity without skill is worse, infinitely worse than useless. It is mischievous, nay, dangerous ; mischievous, inasmuch as it does not harm an enemy, and gives him confidence by creating a contempt for his opponents, while it begets a corresponding want of confidence in one's comrades ;—dangerous, inasmuch as it uselessly expends that ammunition, the due economy of which should be one of a soldier's first cares ; and deprives him of it without cause, when it might have been husbanded for a juncture, in which the possession of it might save the soldier's life. The soldier should have this truth impressed firmly on his mind, *that it is better to fire one shot with effect in ten minutes, than to fire ten ineffectual shots in one minute.* It does more execution, and does not waste ammunition.

The fire of infantry must have, in all future warfare, an immense influence in the fate of battles,* and it is to the rendering this as perfect as may be, that our present efforts are directed.

To instruct a man who has passed some twenty years of his life unaccustomed to the use of fire-arms, is doubtless a difficulty ; but a difficulty that, with adequate information and zealous practice, may be so surmounted as to make him nearly as efficient as any of the men of whose prowess some extraordinary facts are extant.

We are of opinion that the firing with ball is by no means essential in practice to the making of an expert marksman ; and it is with this conviction that we would press on instructors, on the one hand, to devote most of their attention to the preliminary exercises recommended in Chapter V.,† of practising aiming, and the management of the rifle in firing, including particularly the steadily pulling the trigger, so as not thereby to change the position of the rifle ; and, on the other hand, would press on recruits to submit patiently and cheerfully to such preliminary exercises, as a certain means of making them skilful shots, and thus affording them the many great advantages which result.

* We have only to refer to the Crimean and Indian wars to substantiate this opinion, expressed before their occurrence in our first edition.

† See the Report of firing by troops at Malta, before and after preliminary practice, in page 49.

In firing with ball, it is almost wholly impossible for the instructor or the men to make the necessary corrections in the position of the rifle, the correctness of aim, the proper elevation, the steadiness of the rifle, or the mode of pulling the trigger ; all essential to a good marksman, and inaccuracy in any one of which will prevent a man becoming a good or sure shot, and cause ammunition to be thrown away. Errors may exist in all these, and yet at the moment of firing hazard may direct the ball to the bull's eye, whereas if due attention be paid to, and sufficient practice be had in these preliminary exercises, under careful inspection and correction, the shot will never be one of hazard, but will always be certain, as the result of skill.

The effect on the recruit, too, of allowing him to fire ball before he has acquired sufficient dexterity to be assured of his mark, will tend to make him a sort of chance shot. He fires, and his ball has gone to the left ; he tries again, the same causes produce similar effects ; he now finds his ball has gone to the right. He fires too high, and to remedy this, he now fires too low. He is quite bewildered, and at length comes to the conclusion that his rifle is faulty, or discovers some other cause, but not that it is his want of knowledge, or want of skill, arising, in great measure, from his having been made to fire ball at a mark, without having had the necessary preliminary instruction and practice to fit him for certainty and success. The result of all this is, that every soldier fires after his own fashion, and that without the possibility of any other correction from those who superintend him, than simply that his ball has failed in this or that manner.

There is another point, and that, too, of no little importance in adopting principally these preliminary exercises,—they are attended with no expenditure of ammunition, and may consequently be used every day ; while ball firing, from its cost, can only be occasionally resorted to, so that the soldier may have a hundred days' practice in the one, for one day's practice in the other. Of the consequence there can be little doubt.

In these preliminary exercises, the end of which is to make the men expert shots, it may be as well, so far as possible, for the superintending officer or instructor to avoid giving the word of command ; since the soldier, accustomed to discipline and prompt obedience, may frequently pay

more attention to the immediate execution of the command, than to correct aiming, or the management of his rifle in firing.

While on the subject of these preliminary exercises, it may be well—by way of impressing on the minds of the instructor and soldier a point of very high importance, the *pulling the trigger* so as not to cause any change in the position of the rifle—to recur to that subject, and notice it a little more in detail, than we found it necessary to do in the former part of this work.

It is not difficult to keep the rifle steady in the direction of the object aimed at, so long as there is no motion in pulling the trigger; but this movement creates at once a difficulty. The pressure on the trigger throws the rifle generally to the right, especially if the spring of the lock be hard. As some means of compensating this, aim should in most cases be taken, therefore, rather to the left than to the right part of an object.

This, however, is not all that is requisite. The man must carefully keep his rifle to the aim, during all the time that he is pulling the trigger, and he must pull the trigger by a steady and continued pressure of the finger, without the slightest jerk or irregularity, and so that he may be almost unaware of the identical moment at which the rifle will go off; and during the whole of this time he should, to ensure the desired result, suspend or stop his breathing. The trigger, it will be remembered, is to be pulled with the second joint of the first finger, and as this is a matter of the very greatest importance, it may be as well for the instructor himself particularly to show each man separately the manner in which this is to be done.

The men, after having pulled the trigger, should still continue to hold the rifle in the line of aim, and observe whether it has changed its position. And the whole of this exercise should be repeated until they have attained a perfect steadiness in position before, during, and after the fire.

In taking aim, the left eye being shut, the right eye is to be fixed steadfastly on the object, or rather on that part of it to which the aim should be particularly directed; and the rifle should be raised gradually until it is accurately in line. Experience has shown, that *to strike an object it is necessary to see it distinctly at the moment of firing.*

There are certain particular rules with reference to taking aim that we have reserved for this place.

When an object of a certain size is fired at, at point-blank range, the centre of the object is the point to be aimed at; for if any of the extremities be taken, there will be greater chance of missing it, by a deviation of the ball, or by inaccuracy of aim.

If aim on either side the centre be taken, it would always be preferable that it should be rather to the left than to the right, to compensate, as was just now observed, for any change of position caused by pulling the trigger.

The first fixed sight on the rifle is for a distance of 100 yards, and the second fixed sight for 200 yards, &c. &c.

The distances from 500 to 900 yards are shown by shifting up gradually the slide of the sight.

If the object be at less than 100, 200 yards, &c. &c., when using the sight for 100, 200 yards, &c., the lower part of the object must be aimed at, because, as we have shown in Chapter V., the trajectory (as seen in figs. II. and VIII.) rises above the line of vision, for all points within the point-blank range.

If the object be exactly at 100, 200 yards, &c., the centre of the object must be aimed at, because the trajectory cuts, or directly meets, the line of vision at point-blank range.

If the object be somewhat beyond 100, 200 yards, &c., when the 100, 200 yards, &c., sight is used, the upper part of the object must be aimed at, because beyond the point-blank range, the trajectory falls below the line of vision.

These rules, of course, have reference to distances within about twenty-five or thirty yards, on either side of point-blank range; since, if the distance be greater, a corresponding allowance of elevation or depression in the aim must be made.

For distances beyond 500 yards, the movable bar or slide of the sight may be adapted very nearly to the actual distance; but it must be borne in mind, that at all intermediate distances at which the movable slide will not exactly indicate the distance, allowance must be made for the difference, by elevating or raising the aim, if the object be beyond point-blank range, and by depressing or lowering the aim, if it be at less than point-blank range.

All this will be readily seen and understood by looking at the diagram or plan (fig. II.) of the line of vision and the trajectory.

To illustrate these rules practically, it would be well to

have a series of targets (as in fig. X.) placed at stated distances in the same horizontal line, the bull's eyes being all placed also in horizontal line, by which means the soldier may be shown the effect of every shot.

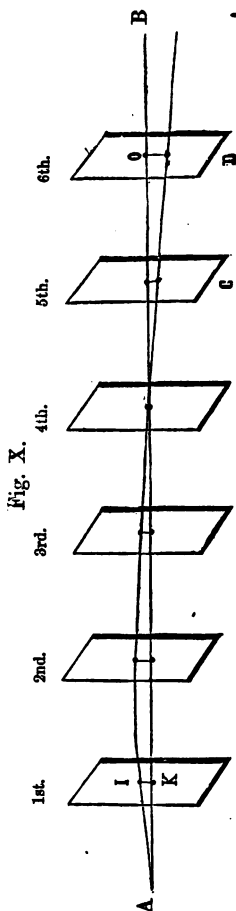


Fig. X.

These targets may be numbered from 1 to 6. The target No. 4 should be placed exactly at point-blank range, and the other targets, being at certain known distances, say at ten yards apart, the target No. 1 would be thirty yards before or within the point-blank range, and the target No. 6 twenty yards behind or without the point-blank range. The soldier may then be directed so to adjust his aim, that his ball shall strike an object at thirty, twenty, or ten yards within point-blank range, at point-blank range, or at ten or twenty yards without, or beyond point-blank range. The target No. 4 not being seen by him, it is clear that he cannot, by firing at the object, which is exactly at point-blank range, attain as a necessary consequence the trajectory in the other targets, and he will therefore be compelled to adjust his aim so as to strike the object he is required to do.

The position of these targets may be varied from time to time, so as to show the trajectory in any required relation to the point-blank range; and thus may the soldier be taught practically, and pretty correctly, the curve of the trajectory—both within, or before—and without, or beyond point-blank range; a knowledge of great importance to him, especially when firing at an object in motion.

These and similar important rules it would be well to

have printed and circulated among the troops for their private and special study.

We now come to another point. There are several positions that may be taken by the soldier in firing :—

First. An upright or standing position.

Secondly. On his knee.

Thirdly. Lying down in any position.

Little need be said on the first position, since the exercises will be principally in this position, and attention to the rules we have already prescribed will render the soldier sufficiently competent in this.

As to the second, the position on the knee, much difference of opinion exists among very competent authorities as to its advantage ; some of them considering it to be avoided, as much as may be, from its not being military ; from its affecting the accuracy of the fire ; and from the loss of time occasioned in loading, arising from the necessity of rising to an upright position for loading, and returning again to the same position for firing. It has therefore been recommended that in practice it should be used but seldom.

On this point, we would, however, bring under the reader's notice, and submit to the consideration of instructors, the remarks made by a very high French authority in an elaborate work on firing with portable arms. He says :

"It is incontestible that when the soldier is in some sort left to himself, when he is out of the ranks, in a word, when employed as a sharpshooter, that his skill, as a marksman, produces its best effect. Ought he in such situation to be compelled to take this or that position ? Certainly not. The man places himself as he finds best, and takes the position most convenient to him. For the great majority of men, the position on the knee is preferable, as to steadiness and firmness, to the upright position ; it allows him to aim more certainly, and fatigues the left arm much less, by the support afforded to the elbow by the knee, and is almost sure to produce shots of more effect. A well-practised soldier will easily take and quit his position ; besides, it has this advantage, that it only exposes half the surface to the fire of an enemy. It cannot be termed unmilitary, since the front rank is frequently obliged to take this position.

"We are therefore far from thinking that this position

"should be exceptional ; we think it should be particularly attended to, and more especially when men are likely to be employed in detached bodies, or singly ; and we are quite sure that we have with us the opinion of all the officers who are generally employed as instructors in firing, when we say that it is the position *par excellence* for every man whom it is desired to make a finished marksman."

The third class of positions requires from us no particular notice here.

We have, throughout this treatise, used the term "rifle," and some portion of it has particular and exclusive reference to that weapon. We have confined ourselves to this term, "rifle," to avoid unnecessary repetition and confusion ; but, as will readily be understood by the intelligent reader, the greater part of our essay will equally apply to the musket, or any other portable fire-arm, that may be employed. There is, however, one cause of deviation in the musket, which does not exist in the rifle. For the musket, the ball is cast somewhat smaller than the bore, and leaves, therefore, a space between its surface and the barrel, when it is rammed down. This space is called "windage." Now, if the ball be not, as it very seldom is, placed exactly in the centre of the axis of the barrel, the powder exploding in this windage, as well as below the ball, occasions a deviation in the ball, and not only so, but makes sometimes a marked difference in the range, and even should the ball be placed exactly in the centre of the axis of the barrel, the unequal ignition of the powder may occasion a deviation.

On this, and many other accounts, it is impossible to fire with a musket with the same precision as a rifle. Much, however, of this difference may be compensated by care being taken in the making the cartridges and in the loading.

The principal difference between the rifle and the infantry musket, lies in the difference between the ranges. Experience has shown that the effective range of the musket is about 100 yards.

In the same manner as in the case of the rifle, the trajectory rises above the line of vision, within or short of this range, and falls below, without, or beyond it.

In order, therefore, to strike an object at less than 100 yards, the aim must be taken below the line of vision. At 100 yards, it must be taken at the object ; and above 100

yards, the aim must be taken above the object, in the proportion in which the trajectory lies above or below the line of vision.

To reduce this to practical rule, we will suppose the object to be struck by an ordinary musket-ball, to be an infantry soldier.

At 125 yards and any shorter distance near to it, aim at the centre of the soldier.

At 150 yards aim at his breast.

At 175 yards aim at his head.

At 200 yards aim at the top of the chako.

Beyond 200 yards, there is no point within the limits of the man, at which aim can be taken with a common musket.

Suppose, again, that the object to be struck is a cavalry soldier.

At 125 yards, or a little less, aim must be taken, with the musket, at the horse's chest.

At 150 yards, at his head.

At 175 yards, at the breast of the rider.

At 200 yards, at the rider's head.

At 225 yards, at the top of his helmet.

There is one other point to which we must advert, and which, though apparently of minor importance, may yet have important effects in retarding the progress of some of the younger recruits; and this is the recoil, or kick of the fire-lock. This may arise, either from an excessive charge, or from the piece not being held firmly pressed to the shoulder at the moment of firing.

The latter cause is the only probable one in the army, since the cartridges are all adapted as a proper charge to the rifle or musket. The remedy, therefore, for the recoil or kick, lies with the soldier himself, by his holding the rifle very firmly to his shoulder; and, independently of avoiding recoil, the holding firmly the musket to the shoulder has another essential advantage, a tendency to keep steady the musket in firing.

Sometimes, with every care and precaution, a musket may miss fire. In this case it should still be held to the shoulder, until all chance of its going off has ceased; since, not unfrequently, it may hang fire for several seconds, and if removed too soon, might cause an accident to the man or his comrades. A skilful and steady shot may always be recognised by his attention to this precaution.

If a musket should miss fire, care should also be taken, in

pricking or cleaning the nipple, to direct the muzzle away from any one, as it often happens that a portion of the percussion powder is left on the nipple, and will, by friction in cleaning, cause the charge to explode.

Such are the general directions, within the limits of which will be found what is essential for a soldier to observe in this branch of his duty. We may add to this, that if it should be his fortune to be called into the field to meet his country's foes, great care must be taken by him in firing, that it be not hurried, and that he present deliberately; bring up his firelock gradually; and look steadily at his object before he fires,—otherwise his fire will lose all its effect upon the enemy. In proportion as a cool and well-directed fire serves to distract and throw an enemy into disorder, so a wild, confused, and hurried fire (which is always without effect) is calculated to give him confidence, and a contempt for his opponent. It is impossible, therefore, to labour too much to give to soldiers the habit of steady, cool, and effective firing. They should bear in mind, that nothing makes so strong an impression upon an enemy as the thinning his ranks by a well-directed fire, and that nothing tends to animate and encourage troops more than the diminished fire from ranks so thinned; and besides this, it affords the best chance of adopting that in which the British soldier has won so many laurels—"a successful charge."

Another point of immense importance cannot be too strongly impressed on the soldier—*not to throw away his ammunition*; he cannot be too careful of it, and should remember that every heedless or careless shot deprives him of that which may aid to win a battle, or perchance to save his own life.

It has been said, that you never can place British troops too near an enemy, and in a figurative sense, as descriptive of courage and daring, this is still as true as ever; but as a matter of military science, and a means of obtaining victory with the least expenditure of human life, which is the end of every wise and humane commander, the ability to place troops at distances at which they will be less exposed to destruction, except by skill, tends to render warfare more scientific, and therefore less generally sanguinary.

In this view, we cannot but consider the rifle, like every other invention in warlike weapons, which are more destructive than those by which they have been preceded, as a valu-

able addition to our military implements ; and although it may oblige us to keep at a more respectful distance from our enemies, than has heretofore been our custom, yet there can be no doubt that that will be far from being a reason against our giving a good account of them, when we are called on to prove that we are now as efficient with the rifle as we have shown ourselves heretofore with the musket. We hope that the necessity of this may seldom arise, but if it should, we know the British soldier will do his duty. Finally, we would earnestly direct the soldier's attention to the specific powers of the new rifle. Unquestionably the adoption of this arm has greatly increased the value of skirmishing, and proportionately diminished the efficiency of firing by companies. Indeed, the fact has been established by actual experiment, that fifty skirmishers armed with the Enfield weapon, will do as much execution as a hundred firing by companies of two deep rank and file.

A consideration of this fact will influence commanders in dealing with an enemy in the field. If the enemy be armed with short range unrifled weapons, he should be attacked as much as possible at distances beyond 150 yards, at which range the accuracy of flight due to rifling counts for little ; and small arms having projectiles of nearly equal weight, and possessing equal facility of loading, will be nearly equal in the field. On the contrary, the enemy thus armed with an inferior weapon, will do his best to bring about a short range conflict, well convinced that it is the best means of neutralising the advantages of his opponent.



CHAPTER XI.

A SERIES OF LESSONS, CONTAINING QUESTIONS ON
THE SUBJECTS TREATED OF IN THE MANUAL.

LESSON I.

QUESTIONS.	ANSWERS will be found at	
	PAGE	
What is the Rifle?	.	25
What is it as an arm of projection?	.	25
What, as an arm of manual offence and defence?	.	25
What is the weight of the Enfield Rifle?	.	26
What its length with bayonet?	.	26
What its length without bayonet?	.	26
What is the length of the barrel?	.	26
Of what figure is the bore?	.	26
What is the diameter of the bore?	.	26
What number of grooves are there in the barrel?	.	26
What is the depth of the grooves?	.	26
What is the width of the grooves?	.	26
What turn have the grooves?	.	26
What is the weight of powder in the charge?	.	26
What is the form of the bullet?	.	26
What is the diameter of the bullet?	.	26
What is the length of the bullet?	.	26
What is the weight of the bullet?	.	26

LESSON II.

Of how many parts does the rifle consist?*	.	26
What are the several parts of the <i>stock</i> ?	.	26
Which is the butt?	.	26
Which is the hand?	.	26
Which is the head?	.	26
Which is the swell?	.	26
Which is the shaft?	.	26
Which are the ring-bands?	.	26
Which are the catch-springs?	.	26

* For the purpose of this lesson it would be well to have an old rifle that would not be injured by being often taken to pieces.

It will not be necessary to require answers to these questions in the very words of the text, so that the answers show the subject inquired of is understood.

QUESTIONS.	ANSWERS will be found at PAGE
What are the several parts of the <i>barrel</i> ?	27
Which is the breech?	27
Which is the muzzle?	27
Which is the breech-nail?	27
Which is the lump?	27
What are the <i>sights</i> ?	27
Which is the bed of the back sight?	27
Which the flanges?	27
Which the side bar?	27
Which the leaf?	27
Which the pin?	27
Which is the <i>lock</i> ?	27
Which is the main-spring?	27
Which the tumbler?	27
Which the bridle?	27
Which the sear?	27
Which the sear-spring?	27
Which is the <i>ramrod</i> ?	27
Which is the head?	27
Which the swell?	27
What is the <i>bayonet</i> ?	27
Which is the blade?	27
Which the socket?	27
Which the locking ring?	27
Which is the <i>trigger</i> ?	27
Which is the blade?	27
Which the finger?	27
Which the box?	27
Which the stud?	27
Which is the plate?	27

LESSON III.

Will a bullet fired from a rifle continue in motion with the same velocity?	30
And in the same line of motion?	30
What is the resistance that would lessen its velocity, or stop its motion?	30
What is the resistance that would cause it to deviate from its line of motion?	30
Does it proceed in a straight line after leaving the rifle?	30
Does it afterwards form a curved or bent line?	31
Draw, with a piece of chalk on this board, a line showing such curved or bent line	31
Now, explain from the drawing you have made, how the resistance of the air and the force of gravity cause the bullet to take such a course	31
Is the trajectory the curved or bent line of which you have already spoken, and which you have drawn?	31

QUESTIONS.

ANSWERS
will be found at
PAGE

- Then the trajectory forms a curved line, because the bullet is subject to the resistance of the force of gravity? . . . 31
- In other words, the bullet does not continue to go in a straight line, but in a curved line, which is called a trajectory. . . 31

LESSON IV.

- On what do the general principles of taking aim and firing depend? . . . 31
- Are these terms of science? . . . 31
- What is the line of vision described in plain language? . . . 31
- Why is it called the line of vision? . . . 31
- What is the line of projection? . . . 31
- Why is it called the line of projection? . . . 31
- What is the trajectory? . . . 31
- Are these lines real or imaginary? . . . 31
- What is the scientific definition of the line of vision? . . . 32
- What of the line of projection? . . . 32
- What of the trajectory? . . . 32
- Draw these three lines on the board . . . 33
- Now show me the line of vision . . . 33
- Show me the line of projection . . . 33
- Show me the trajectory . . . 33

LESSON V.

- Do the lines of projection and the trajectory continue in the same course? . . . 33
- How long, then, do they continue in the same course? . . . 33
- What causes them to differ in their course? . . . 33
- Does this force of gravity act at once on the ball, and cause it to fall immediately to the earth? . . . 33
- By its acting gradually, what is the result? . . . 33
- Is the resistance of the air on the ball considerable? . . . 33
- Suppose a rifle were fired in a space in which there was no air, would the curve of the trajectory differ from the curve, if fired in a space filled with air, or, in other words, in the open air? . . . 34
- Show me what you mean on this board . . . 34
- To what force is a bullet fired in a vacuum subject? . . . 34
- And what is the result of the action of these forces? . . . 35
- Show me, in the best manner you can, on this board . . . 35
- Now describe to me, in the best manner you can, what you have shown me on the board . . . 35
- What is the "culminating point?" . . . 36
- Why does the bullet rise to the culminating point? . . . 36
- In descending from the culminating point, does the bullet pass over the same distance in the same time, and from the same curve as in rising to it? . . . 36
- Is this owing to its being fired in a vacuum? . . . 36

QUESTIONS.

ANSWERS
will be found at
PAGE

LESSON VI.

In our last lesson we considered the effect of a bullet fired in a vacuum; we will now consider the difference of effect from its being fired in the open air.

What we are now going to consider is, in fact, what always takes place in common rifle firing—firing in the open air.

Tell me what is the open air, or, as it is called by men of science, the atmosphere?	36
When you put out your hand, can you feel it?	36
But, if you pass your hand quickly up or down, can you feel something?	36
What do you feel?	36
And is this feeling caused by the air?	36
Does it resist the motion of your hand?	36
That is, you do not feel that it resists the motion of your hand?	36
Can you explain to me why?	36
Now, take this sheet of paper and open it, and then move it with the flat part exposed to the resistance of the air	36
What do you find?	36
Now pass it very quickly	36
What do you now find?	36
You find, then, that the air does resist the motion of the paper, and that the more quickly you move the paper, the greater is the resistance of the air?	36
Of what does the air consist?	36
What is the effect of a body passing through it?	36
Is this compression of the particles of the air, and consequent resistance, increased by the increased velocity of the body passing through it?	36
In what direction is this resistance offered?	36
Does this resistance check the velocity of the body passing through the air?	36
Does it at length stop the body?	36
On what does the resistance offered by the air to a rifle bullet depend?	36
Now show me what difference would be made in the form of the trajectory if the bullet were fired in a vacuum, and if fired in the open air	37
Explain this to me	37

LESSON VII.

What is the point-blank?	38
What is point-blank range?	38
Are there two definitions of point-blank range?	38
Which is the definition we shall use in our lessons?	38
Is there a different point-blank range to each line of vision?	38
What is meant by "vertical?"	38
What by "horizontal?"	38
What is a vertical line?	38
What is a horizontal line?	38
What is a plane?	39

QUESTIONS.	ANSWERS will be found at PAGE
What is a vertical plane?	39
What is a horizontal plane?	39
What is an angle?	39
What is the angle of projection?	39
What is the angle of vision?	40
What is the plane of projection?	40
Is the trajectory in this plane?	40

LESSON VIII.

When is the angle of vision equal to the angle of projection?	40
Does the trajectory participate in the movements of the line of vision?	40
When will the ball touch the vertical line passing through the object to be struck?	40
When is the line of vision placed in the plane of projection?	41
Does the trajectory cut the line of vision?	41
At what points?	41
What is the second point of intersection?	41
When is the point-blank range lengthened?	41
Does the trajectory descend below the line of vision?	42
At what point?	42
Does the trajectory rise above the line of vision?	42
At what point?	42
Does the trajectory rise and descend gradually?	42
What aim is necessary to be taken to strike an object at a distance equal to point-blank range?	42
What, an object at a greater distance than point-blank range?	43
What, to strike an object between the two intersections of the line of vision?	43

LESSON IX.

Describe to me the sights on your rifle, and show me the manner in which you use them to strike an object at various distances of point-blank range	43
Is there any difference in the range of your rifle, if you take the front sight full or small?	46
What is meant by taking the front sight full or small? Show me by your rifle	46
What is the reason of this difference?	46
If you hold your rifle so that your sights are not perfectly upright, what would happen?	46

LESSON X.

How do you hold your rifle?	47
What finger do you use to fire?	47
What joint of your finger?	47
How should you pull your trigger?	47
Show me	47
Should you breathe while taking aim and firing?	47
How do you place your head in taking aim?	47
With what eye do you take aim?	47
Should the left eye be closed?	47

QUESTIONS.	ANSWERS will be found at PAGE.
Should you see the object fired at distinctly when you fire ?	48
What is necessary if you fire at an object less than 100 yards when using the 100 yard sight ?	48
What, at 200 yards, &c. &c. ?	48
What, if the object be more than 100 yards,—200 yards, &c. &c. ?	48
At what point of an object should you aim, if you are firing at an object at point-blank range ?	48
What, if within point-blank range ?	48
What, if without point-blank range ?	48
In firing with ball, what should you be careful of in using your cartridge ?	49
In ball firing, how should you manage your rifle in taking aim ?	49
What is the origin of the term "point-blank" ?	52

LESSON XI.

Repeat the parts of the body of a soldier and his equipment, which disappear at various distances	56
Does foggy or cloudy weather make any difference in the apparent distance of objects ?	59
What difference is made by clear light weather ?	59
What difference is made by an avenue of trees ?	59
What from other objects, and the effects of light or shade ?	59
Are there any instruments for judging of distances ?	63
Describe the common rule which is so used	63
Show me its use	64
Describe Thackeray's Stadium	64
Show me its use	64
How much ground does a foot-soldier pass over in a minute at quick march ?	66
How much at a charge ?	66
How much does a horse walk ?	66
How much does he trot ?	66
How much does he gallop ?	66
What space in width does a foot-soldier occupy ?	66
What a trooper ?	66
In cases of soldiers moving, how would you aim ?	66
If they were coming nearer ?	66
If moving further away ?	66
If moving to the right or to the left ?	66
At what part of cavalry should you aim when a horse is walking ?	67
When a horse is trotting ?	67
When a horse is galloping ?	67
Being engaged with an enemy, how should you fire the first round ?	67

Note.—It will be seen that, in the above lessons, we have directed that the soldier should be made to draw rough diagrams on a board. We would suggest that, for this purpose, each instructor should be furnished with a large black board and a piece of chalk.

Should the drawing by the soldiers be impracticable, or create confusion or inconvenience, the instructor himself can draw the diagrams, or follow any other method which he may deem preferable.

CHAPTER XII.

MARKSMEN IN THE ARMY.

The following General Order, instituting a system of "prizes for good shooting" among the infantry and embodied militia, has been promulgated :—

" Horse Guards, March 10, 1858.

"The General Commanding in Chief, with a view to stimulate individual exertion, and to reward the proficiency of soldiers in the use and management of the rifle musket, has been pleased to institute a system of 'prizes for good shooting;' and the accompanying regulations for the award of the same having received the concurrence of the Secretary of State for War, his Royal Highness desires that they may be strictly observed throughout the infantry and embodied militia.

"By command,

"G. A. WETHERALL, Adjutant-General."

"REGULATIONS TO GOVERN THE ISSUE OF PRIZES FOR GOOD SHOOTING.

"1. The regimental prizes for good shooting will be three, viz. :—

"1st Prize.—To the best shot of the battalion, a badge of cross-muskets and a crown, worked in gold, and entitling the wearer to extra pay at the rate of 2d. per day.

"2nd Prize.—To the best shot of each company, a badge of cross-muskets, worked in gold, and carrying with it extra pay at the rate of 1d. per day.

"3rd Prize.—To certain of the first-class shots, to be styled 'marksmen,' and not to exceed 100 per battalion, a badge of cross-muskets, worked in worsted, with 1d. per day additional pay to each wearer.

"2. The badges are to be worked on cloth the colour of the facings of the regiment, and to be worn on the left arm, immediately above the slashed flap of the sleeve.

"3. In order to insure, on the one hand, a high standard of efficiency, and, on the other, to guard against the public being called upon to pay for a lower standard of merit than is necessary, as well as to secure the utmost impartiality in the distribution of the rewards, it is intended that the registers and annual practice returns shall be the data upon which the proficiency of the men shall be estimated.

"4. Accordingly, the best shot of the battalion will be that soldier who, in the practice of the first-class, firing between 600 and 900 yards, obtains the greatest number of points over seven.

"5. The best shot of the company will be that soldier who, in the practice of the first class of his company, firing between 600 and 900 yards, obtains the greatest number of points over seven.

"6. To qualify a soldier for the position of a 'marksman,' and the rewards attaching thereto, he must, in the yearly course of practice, have obtained at least seven points in the first class, firing between 600 and 900 yards, and possess competent knowledge of the laws affecting the flight of the bullet, and the rules to be attended to in maintaining the efficiency of the rifle under all circumstances and conditions, and display the requisite skill in judging distances, being at least in the first class at the final classification of the judging distance practice.

"7. Should it happen that more than 100 men in the battalion (including the best battalion shot and the best shot of a company) come under the conditions specified in the foregoing paragraph, then those men who have obtained the greatest number of points are to be first selected for the reward and distinction. Should two or more men have obtained the same number of points (not less than seven) in the first class, and be otherwise eligible for the reward, reference is to be made to their respective performances in the first and second periods of individual shooting, and those are to be selected who have obtained the greatest number of points therein. Should there still be a tie, reference is then to be made to their respective performances in the judging distance practice, and the preference given to those who are the best judges of distance.

"8: Should the number of paid 'marksmen' in a battalion be reduced by casualties during the year, the number may be completed from those men eligible for the reward (if there are any), under the conditions prescribed in paragraph 6.

"9. As a further inducement to all ranks to vie with each other in this essential part of the soldier's instruction, and in order that every man may feel that, though he may not himself succeed in obtaining a prize, he can assist in obtaining one for his company, his Royal Highness the General Commanding in Chief has further approved a supplementary prize of cross-muskets and crown, worked in gold, but unaccompanied by any pecuniary allowance, being worn on the right arm by the sergeants of the best shooting company of every battalion.

"10. Should a sergeant of the best shooting company be either the best shot of the battalion, the best shot of his company, or a marksman, he will wear the distinguishing badge of that position in addition to the badge sanctioned in the foregoing paragraph.

"11. With a view to insure strict impartiality, it is essential that the several companies of a battalion should be kept as much intact as possible; they should therefore be equalised before the annual course of drill and practice commences, and no transfers be made, except such as are indispensable, until the period for commencing the practice in the following year.

"12. Although the best shooting company can be established wherever a range of 300 yards can be obtained, and the company badge

may be issued accordingly, it is to be clearly understood that no rewards will be granted to battalions unless they have been practised in the three periods of individual firing, as detailed in paragraphs 70, 77, and 85 of the book of instruction; that under no circumstances will the limit of one best shot for a battalion, one for each company, and 100 marksmen, including the two former, ever be allowed to be exceeded; that, as an invariable rule, both the badge and its attendant allowance will have to be surrendered by all who cease, in the next annual course, to fulfil the conditions and maintain the superiority by which these rewards were earned; and that, should the shooting of any battalion fall below the average, the prizes will be wholly withdrawn, and issue of the additional pay suspended.

"13. Should it be ascertained, either through the reports received from the district inspector of musketry, or through any other source, that any undue advantage has been taken by a battalion in the execution of the several exercises in target and judging distance practices, such, for instance, as counting ricochets; placing marks to aim at, to denote the allowance to be made for wind, &c., whereby the practical skill of the soldier in the use of his rifle would be defeated; firing at distances shorter than those enjoined by the regulations, and at a greater number of targets than are prescribed for the several distances; departing in any way from the rules defined for conducting the different practices, or otherwise deviating from the spirit of the musketry regulations, published to insure a uniformity of procedure throughout the army, such battalion will not be eligible for the rewards granted by these regulations.

"14. The best shot of the battalion and the best shot of the company will be allowed, in addition to the reward as such, the extra pay, as 'marksmen;' but no soldier will be eligible for a reward for shooting who is not in the first class in the final classification of the judging distance practice.

"15. The 100 prize-holding marksmen are to be distributed between service and dépôt companies in the following manner, viz. :—

" 10 service companies	90	} 100
" 2 dépôt companies	10	

"16. The extra pay is to be drawn, and the distinguishing badges are to be worn for one year, commencing on the first day of the quarter succeeding that in which the annual report of practice is required to be made up, or as soon as the necessary authority is received.

"17. Badges of distinction will be supplied on application in the usual annual requisition for clothing, and are to be retained in the quartermaster's stores for issue under the provisions of these regulations.

"By command of His Royal Highness the Duke of Cambridge,
General Commanding-in-Chief.

"G. A. WETHERALL, Adjutant-General."





